2008.02932

HAND DELIVERED

SEP 0 8 2008

UTAH DIVISION OF
SOLID & HAZARDOUS WASTE

PROMONTORY LANDFILL LLC
CLASS I LANDFILL
PERMIT APPLICATION

Prepared for

PACIFIC WEST, L.L C.

1515 West 2200 South, Suite C

Salt Lake City, Utah 84119

Prepared by

ADVANCED ENVIRONMENTAL ENGINEERING, INC.

1975 North Main, Suite #3

Layton, Utah 84041

August 2008

Utah Class I and V Landfill Permit Application Form

Part I General Information	APPLICANT: PLEASE COMPLETE ALL SECTIONS		
I. Landfill Type	☒ Class I ☐ Class V	II. Application Type	☐ New Application ☒ Renewal Application ☐ Facility Expansion ☐ Modification

For Renewal Applications, Facility Expansion Applications and Modifications Enter Current Permit Number 0202

III. Facility Name and Location

Legal Name of Facility: Promontory Landfill			
Site Address (street or directions to site): Southwest tip of Promontory Peninsula		County: Box Elder	
City: None	Zip Code: N/A	Telephone: N/A	
Township: 6N	Range: 5&6W	Section(s): 13, 14, 19, 23, 24, 25, & 30	Quarter/Quarter Section: N/A / Quarter Section: N/A
Main Gate Latitude: 41 degrees 12 minutes 55 seconds		Longitude: 112 degrees 28 minutes 5 seconds	

IV. Facility Owner(s) Information

Legal Name of Facility Owner: Utah Landfill and Ballast, LLC			
Address (mailing): 1830 West Highway 112			
City: Tooele	State: UT	Zip Code: 84074	Telephone:

V. Facility Operator(s) Information

Legal Name of Facility Operator: Same as above			
Address (mailing):			
City:	State:	Zip Code:	Telephone:

VI. Property Owner(s) Information

Legal Name of Property Owner: Same as IV above			
Address (mailing):			
City:	State:	Zip Code:	Telephone:

VII. Contact Information

Owner Contact: Garry L. Bolinder		Title: Managing Member	
Address (mailing): 1830 West Highway 112			
City: Tooele	State: UT	Zip Code: 84074	Telephone: (435) 843-1550
Email Address: garry@bolinderresources.com		Alternative Telephone (cell or other): (435) 840-2800	
Operator Contact: Same as above		Title:	
Address (mailing):			
City:	State:	Zip Code:	Telephone:
Email Address:		Alternative Telephone (cell or other):	
Property Owner Contact: Same as VII above		Title:	
Address (mailing):			
City:	State:	Zip Code:	Telephone:

Utah Class I and V Landfill Permit Application Form

Part I General Information (Continued)

VIII. Waste Types (check all that apply)			IX. Facility Area	
☒ All non-hazardous solid waste (see R315-315-7(3) for PCB special requirements) OR the following specific waste types:			Facility Area	2000 acres
Waste Type	Combined Disposal Unit	Monofill Unit	Disposal Area	1000 acres
☐ Municipal Waste	☐	☐	Design Capacity	
☐ Construction & Demolition	☐	☐	Years	100+
☐ Industrial	☐	☐		
☐ Incinerator Ash	☐	☐		
☐ Animals	☐	☐	Cubic Yards	640 million
☐ Asbestos	☐	☐		
☐ PCB's (R315-315-7(3) only)	☐	☐		
☐ Other ______	☐	☐	Tons	364 million

X. Fee and Application Documents

Indicate Documents Attached To This Application ☐ Application Fee: Amount $

☐ Facility Map or Maps ☐ Facility Legal Description ☐ Plan of Operation ☐ Waste Description
☐ Ground Water Report ☐ Closure Design ☐ Cost Estimates ☐ Financial Assurance

Class V Special Requirements
☐ Documents required by UCA 19-6-108(9) and (10)

I HEREBY CERTIFY THAT THIS INFORMATION AND ALL ATTACHED PAGES ARE CORRECT AND COMPLETE.

Signature of Authorized Owner Representative: Garry L Bolinder	Title: Manager	Date: April 25th 2011
Name typed or printed: Garry L Bolinder	Address: 1830 W HWY 112 Tooele UT 84074	
Signature of Authorized Land Owner Representative (if applicable): Garry L Bolinder	Title	Date
Name typed or printed: Garry L Bolinder	Address: SAME	
Signature of Authorized Operator Representative (if applicable): Garry L Bolinder	Title: As Above	Date
Name typed or printed: Garry L Bolinder	Address	
Email Address: garry@bolinderresources.com	Alternative Telephone (cell or other): (435) 840-2800	

ENGINEER'S CERTIFICATION AND DECLARATION

I, Chet A Hovey, hereby certify that I am a Registered Professional Civil Engineer holding registration number 368556-2202 in the state of Utah I declare that this Promontory Landfill LLC Class I Landfill Permit Application was prepared under my direct supervision for Pacific West, L L C , Salt Lake City, Utah

REGISTERED PROFESSIONAL ENGINEER
No 368556-2202
CHET A HOVEY
9/4/08
STATE OF UTAH

Chet A Hovey, P E
Utah Reg 368556-2202

ENGINEER'S CERTIFICATION AND DECLARATION
October 2009 Permit Application Revisions

I, Anthony G Hiatt, hereby certify that I am a Registered Professional Engineer holding registration number 174673-2202 in the state of Utah I declare that this Promontory Landfill LLC Class I Landfill Permit Application Revisions dated October 2009, were prepared under my direct supervision for Shoshone Promontory LLC

LICENSED PROFESSIONAL ENGINEER
No 174673-2202
ANTHONY G
HIATT
STATE OF UTAH

Anthony G Hiatt
October 9, 2009

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CHAPTER I
INTRODUCTION

1 1 INTRODUCTION

This Renewal Application was developed to provide an update to the original Permit Application that was generated in 2003 by AQUA Engineering Only out dated information has been changed from this original Permit Application

Promontory Landfill, LLC (hereafter called OWNER) and municipalities and counties of the State of Utah are investigating the feasibility of creating a Class I Landfill on the southwest portion of Promontory Point Peninsula, Box Elder County, Utah This report has been prepared to satisfy the requirements of the State of Utah Solid Waste Permitting and Management Rules

The site is located on the west side of the southern tip of the Promontory Point Peninsula and is protected visually from the Wasatch Front by several small islands and mountains Access to the proposed landfill facility would be either by way of the Union Pacific Railroad causeway, a private dike, or a county road as shown on Figure 1 1 The site surficial soils consist of sand, clay, silt, gravel, and rock The site slopes moderately draining southwest into the Great Salt Lake and is covered with vegetation including cheat grass, galleta grass, crested wheatgrass, greasewood, halogeton, and rabbit brush

Construction of the Class I Landfill is planned to begin soon after approval of the Permit Application and permit issuance by the State of Utah, Department of Environmental Quality (DEQ) The proposed Class I Landfill would be designed, operated, and constructed in accordance with all Federal and State Laws and regulations applicable to its management and operation

P:\Pacific West\00001_Promontory Point Landfill\dwg\1.1_VICINITY MAP.dwg 09/04/2008 RM

IMAGE SOURCE: GOOGLE EARTH

1 2 EXISTING UTILITIES

The remote nature of the Promontory Peninsula has meant few if any utilities have been developed Power is available to serve mechanized operations and wells Site water would be provided by local sources See Figure 1 2 for a map of existing utilities on and near by the landfill site No gas lines traverse the Promontory Peninsula Telephone service is currently not available through landlines The nearest landline, which could feasibly be brought to the site is located to the north and east but is cost prohibitive All communication on and off the landfill site would be by cell phone or radio

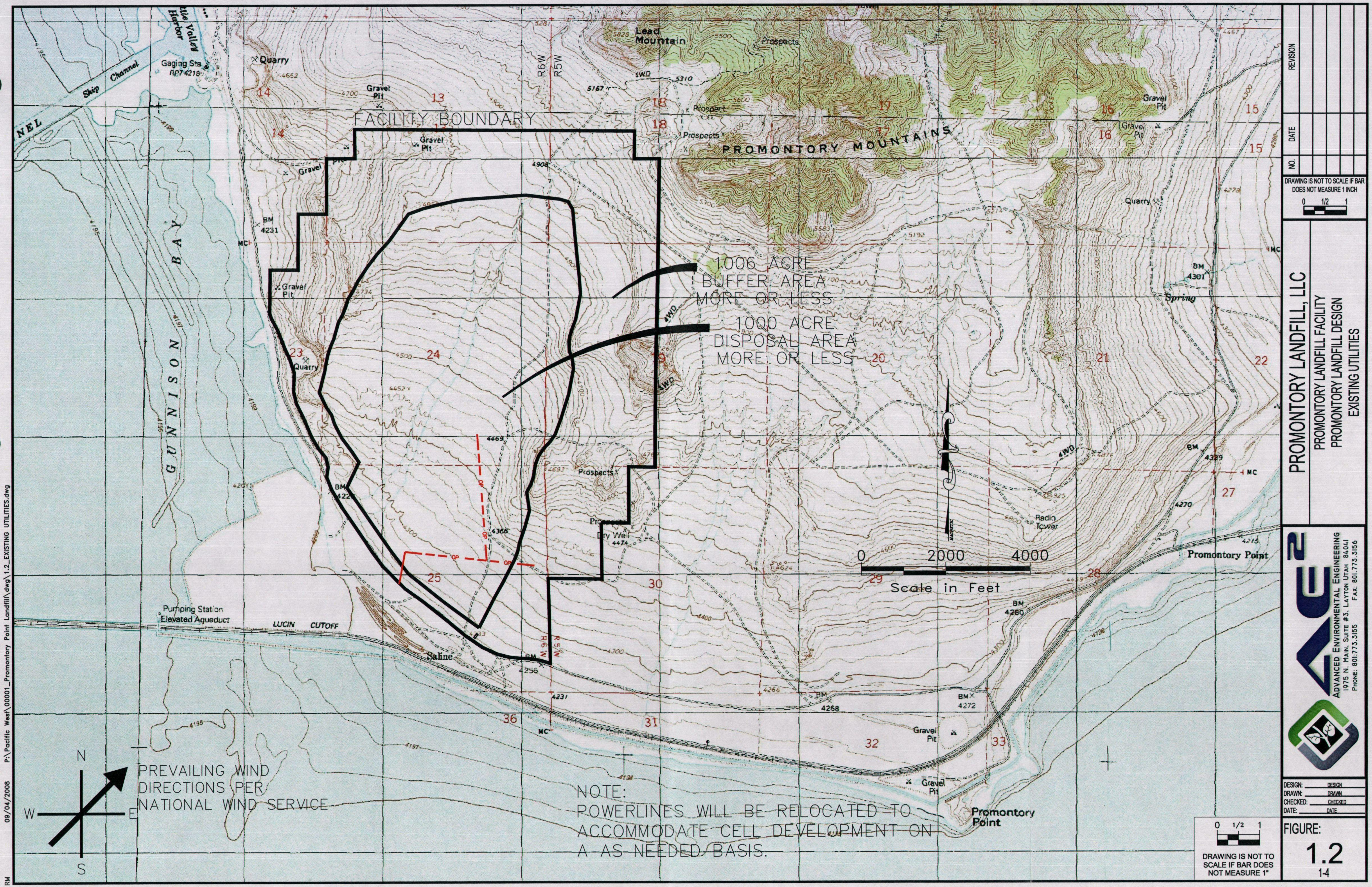
1 3 PURPOSE AND NEED

The purpose of this Permit Application is to characterize the construction and operation of the proposed Class I Landfill for permitting and management purposes The need for the landfill results from the expanding waste disposal requirements of the rapidly growing population in Northern Utah Many of the existing landfills along the Wasatch Front are nearing closure or are under scrutiny due to encroachment of expanding urban areas The proposed landfill would provide an alternative disposal option for the municipalities and counties of Utah, while offering the advantages of low operational cost, long-term capacity, and relatively low transportation costs Participants through an interlocal agreement would have the opportunity to administer and manage the proposed landfill Owner/Operator Contracts are included in Appendix A Municipal solid waste (MSW) would be transported to the site by truck and/or railcar

1 4 GENERAL INFORMATION

1 4 1 Facility Name

Promontory Landfill Facility



DRAWING SOURCE: AQUA ENGINEERING, INC.

P:\Pacific West\00001_Promontory Point Landfill\dwg\1.2_EXISTING UTILITIES.dwg

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1 4 2 Facility Owner

Promontory Landfill L L C

1 4 3 Facility Operator

Pacific West, L L C

1 4 4 Facility Size and Location

Facility Area, 2006 Acres more or less

Class I Landfill, approximately 1000 acres more or less

Promontory Point, Box Elder County, Utah

1 4 5 Types of Use

Class I Landfill

1 4 6 Contact Person

Mike Forrest

1515 West 2200 South, Suite C

Salt Lake City, Utah 84119

Phone 801-972-2727

Note Mike Forrest has been given legal authorization to sign for and in behalf of Pacific West, L L C Refer to authorization letter included in Appendix A of this document

CHAPTER II

FACILITY CHARACTERIZATION

2 1 GENERAL SETTING

The landfill site is not currently zoned A Conditional Use Permit was issued by Box Elder County Planning Department and is included in Appendix B The entrance of the facility would be located at 41°12'55" north latitude and 112°28'05" east longitude

2 2 FACILITY DESCRIPTION

Figure 2 1 shows the boundary of the 2006-acre facihty covered by this Permit Application The figure indicates the proposed buffer and disposal areas The disposal area covers approximately 1000 acres and is bounded by a 1006-acre buffer area meeting State and Federal requirements

2 3 PROOF OF OWNERSHIP AND FACILITY LEGAL DESCRIPTION

Figure 2 1 also details the ownership of lands surrounding the proposed landfill facility As the figure indicates, Chournos Promontory and Young Resources, hold title to much of the adjacent property Both of these owners are participants in Promontory Landfill LLC Proof of ownership is included m Appendix C The following is a property description of the proposed landfill facility

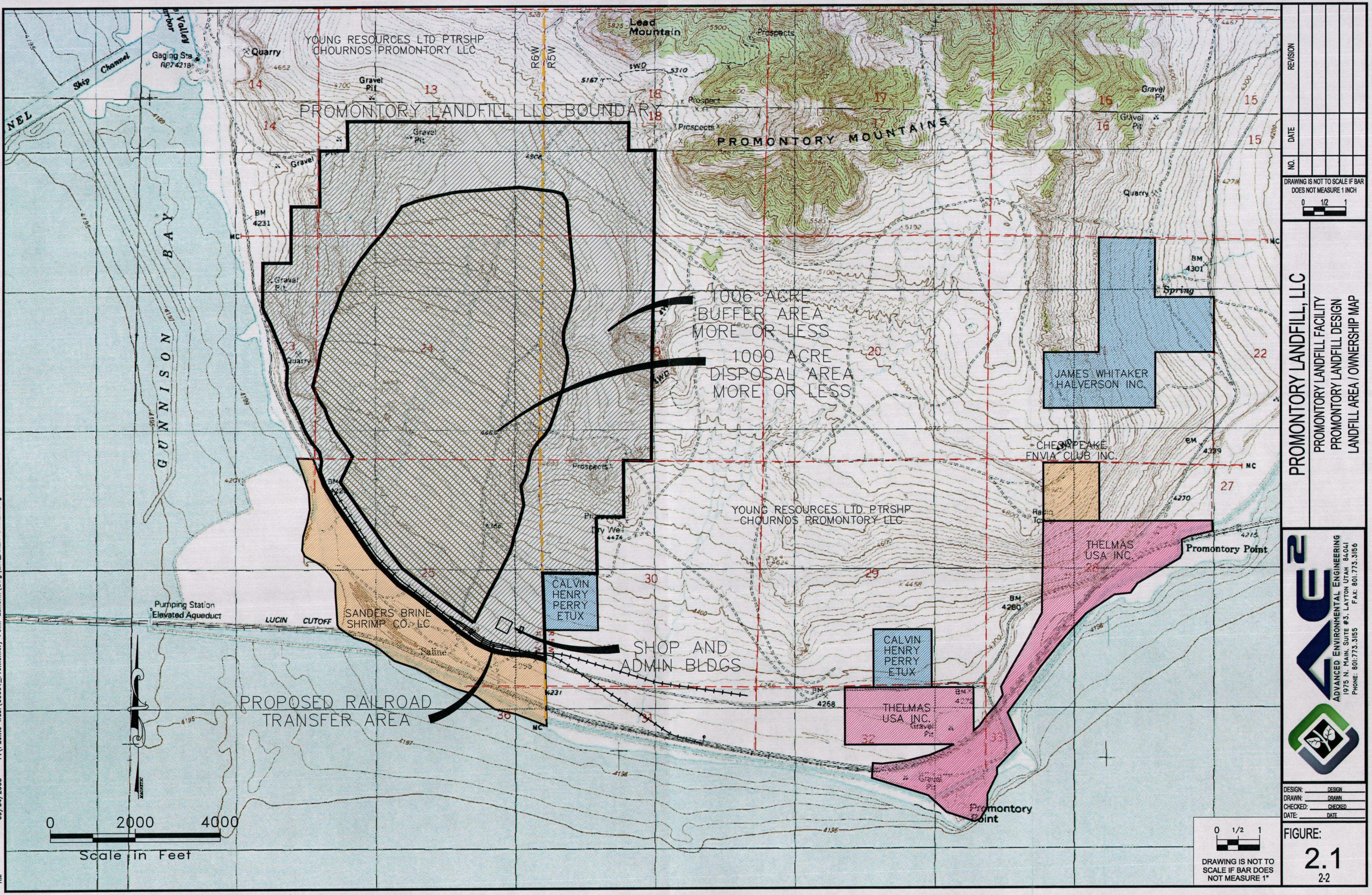
PROMONTORY LANDFILL PARCEL-2006 ACRES

Property Description.

The real property situated in Box Elder County, Utah, more particularly described as follows

The East half of the Northwest Quarter, Section 19, Township 6 North, Range 5 West, Salt Lake Base and Meridian

The Southwest Quarter, Section 19, Township 6 North, Range 5 West, Salt Lake Base and Meridian



DRAWING SOURCE: AQUA ENGINEERING, INC.

The Southwest Quarter, Section 19, Township 6 North, Range 5 West, Salt Lake Base and Meridian

The West half of the Northeast Quarter, Section 30, township 6 North, Range 5 West, Salt Lake Base and Meridian

The West half of the Northwest Quarter, Section 30, Township 6 North, Range 5 West, Salt Lake Base and Meridian

The Southeast Quarter, Section 13, Township 6 North, Range 6 West, Salt Lake Base and Meridian

The Southeast Quarter of the Southeast Quarter of the Southeast Quarter, Section 14, Township 6 North, Range 6 West, Salt Lake Base and Meridian

The Northeast Quarter of the Northeast Quarter of the Northeast Quarter, Section 14, Township 6 North, Range 6 West, Salt Lake Base and Meridian

The South half of the Northeast Quarter of the Northeast Quarter, Section 23, Township 6 North, Range 6 West, Salt Lake Base and Meridian

The Southeast Quarter of the Northeast Quarter, Section 23, Township 6 North Range 6 West, Salt Lake Base and Meridian
Less The existing County Road and all the land lying Westerly of said County Road

The Northeast Quarter of the Southeast Quarter, Section 23, Township 6 North, Range 6 West, Salt Lake Base and Meridian
Less The existing County Road and all land lying Westerly of said County Road

The Southeast Quarter of the Southeast Quarter, Section 23, Township 6 North, Range 6 West, Salt Lake Base and Meridian
Less The existing County Road and all land lying Westerly of said County Road

The Northeast Quarter, Section 24, Township 6 North, Range 6 West, Salt Lake Base and Meridian

The South half, Section 24, Township 6 North, Range 6 West, Salt Lake Base and Meridian

The Northeast Quarter, Section 25, Township 6 North, Range 6 West, Salt Lake Base and Meridian

The Southeast Quarter, Section 25, Township 6 North, Range 6 West, Salt Lake Base and Meridian
Less The existing County Road and all land lying Southerly of said County Road

The Southwest Quarter, Section 25, Township 6 North, Range 6 West, Salt Lake Base and Meridian

Less The existing County Road and all land lying Southwesterly of said County Road

The Northwest Quarter, Section 25, Township 6 North, Range 6 West, Salt Lake Base and Meridian

Less The existing County Road and all land lying Southwesterly of said County Road

The West half of the Southwest Quarter of Section 18, Township 6 North, Range 5 West, Salt Lake Base and Meridian

The Southeast Quarter of the Southwest Quarter of Section 18, Township 6 North, Range 5 West, Salt Lake Base and Meridian

The West half of the Northeast Quarter of the Southwest Quarter of Section 18, Township 6 North, Range 5 West, Salt Lake Base and Meridian

The Southeast Quarter of the Northeast Quarter of the Southwest Quarter of Section 18, Township 6 North, Range 5 West, Salt Lake Base and Meridian

The Northwest Quarter of the Northwest Quarter of Section 19, Township 6 North, Range 5 West, Salt Lake Base and Meridian

The Southwest Quarter of Section 13, Township 6 North, Range 6 West, Salt Lake Base and Meridian

Less The Northwest Quarter of the Northwest Quarter of the Southwest Quarter of Section 13, Township 6 North, Range 6 West, Salt Lake Base and Meridian

The Northwest Quarter of Section 24, Township 6 North, Range 6 West, Salt Lake Base and Meridian

Together with all improvements, appurtenances and any water rights thereto belonging

CHAPTER III
GEOHYDROLOGIC ASSESSMENT

3 1 GEOTECHNICAL AND GEOLOGIC STUDY

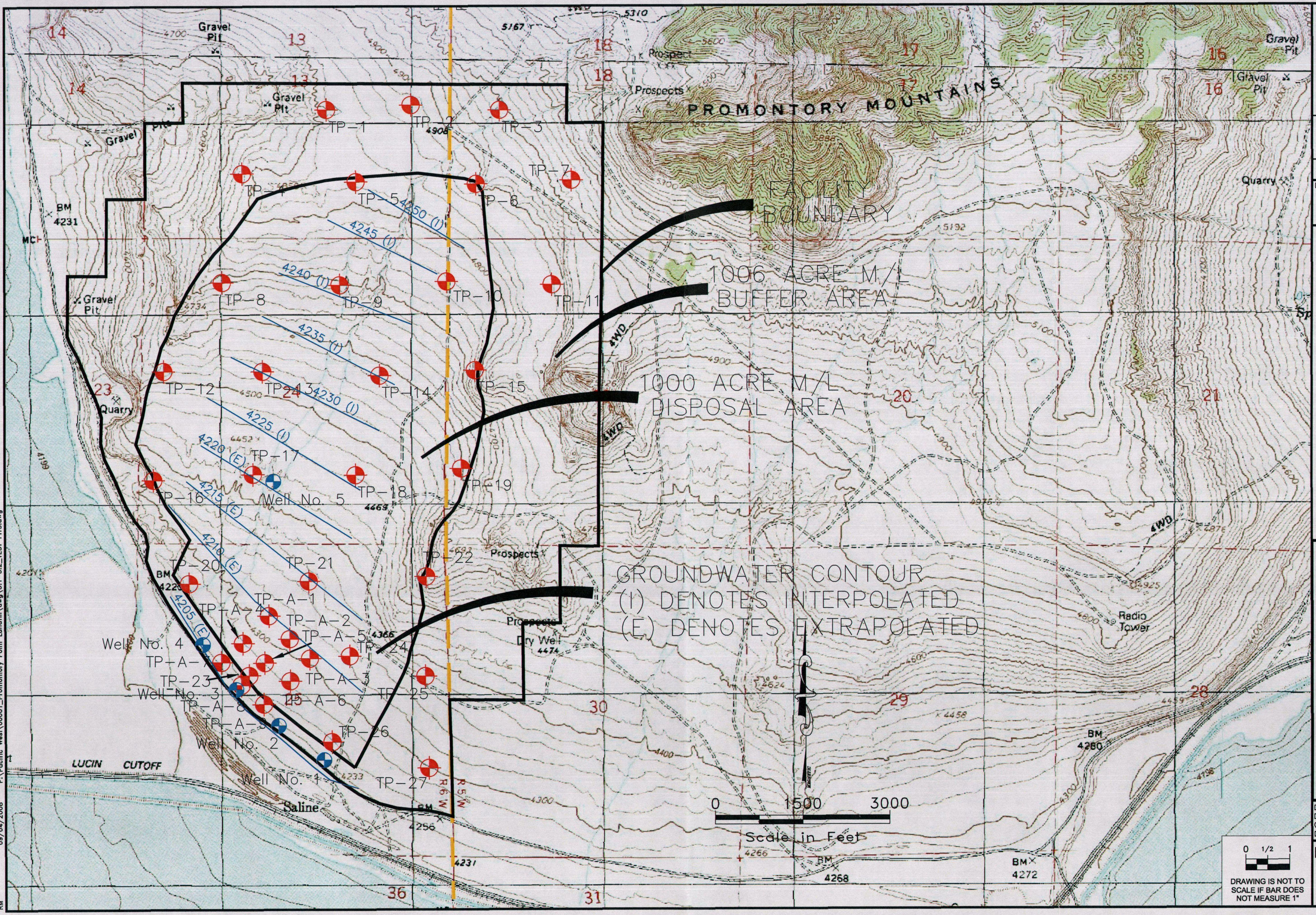
Per the original Permit Application, Applied Geotechnical Engineering Consultants, Inc (AGEC) supplied a Geotechnical and Geologic Study of the proposed Promontory Landfill site and found it suitable for the proposed landfill design All conclusions not otherwise referenced in section 3 1 are conclusions of AGEC The AGEC study in its entirety is included in Appendix D

3 1 1 Subsurface Conditions

A total of 36 test pits and 5 groundwater monitoring wells were constructed at the landfill site as shown on Figure 3 1 Variations of subsurface conditions were found throughout the site See Figures 3 2, 3 3, 3 4, and 3 5 for test pit sections and monitoring well logs Many of the explorations consisted of 2-9 inches of topsoil overlaying clay or sand and gravel Bedrock was encountered ranging at a depth of 1-41 feet throughout the site except at monitoring Well #1 in which bedrock was not discovered

3 1 2 Stability Analysis

The Regulations state that municipal landfills must be designed to withstand seismic accelerations if they are located in a seismic impact zone A seismic impact zone is defined as an area with a 10% or greater probability that the maximum horizontal acceleration in lithified material would exceed 0 10 g in 250 years According to Blake, T F, et al (2002), there is a 10% probability of ground acceleration exceeding 0 55 g in a 250-year period at the landfill site The Promontory Landfill Facility is therefore located in a seismic impact zone The proposed cell has been designed to



DRAWING SOURCE: AQUA ENGINEERING, INC.

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REVISION | DATE | NO.

DRAWING IS NOT TO SCALE IF BAR DOES NOT MEASURE 1 INCH

0 1/2 1

PROMONTORY LANDFILL, LLC

PROMONTORY LANDFILL FACILITY

PROMONTORY LANDFILL DESIGN

SUBSURFACE EXPLORATION

ADVANCED ENVIRONMENTAL ENGINEERING

1975 N. MAIN, SUITE #3, LAYTON UTAH 84041

PHONE: 801.773.3155 FAX: 801.773.3156

DESIGN: DESIGN

DRAWN: DRAWN

CHECKED: CHECKED

DATE: DATE

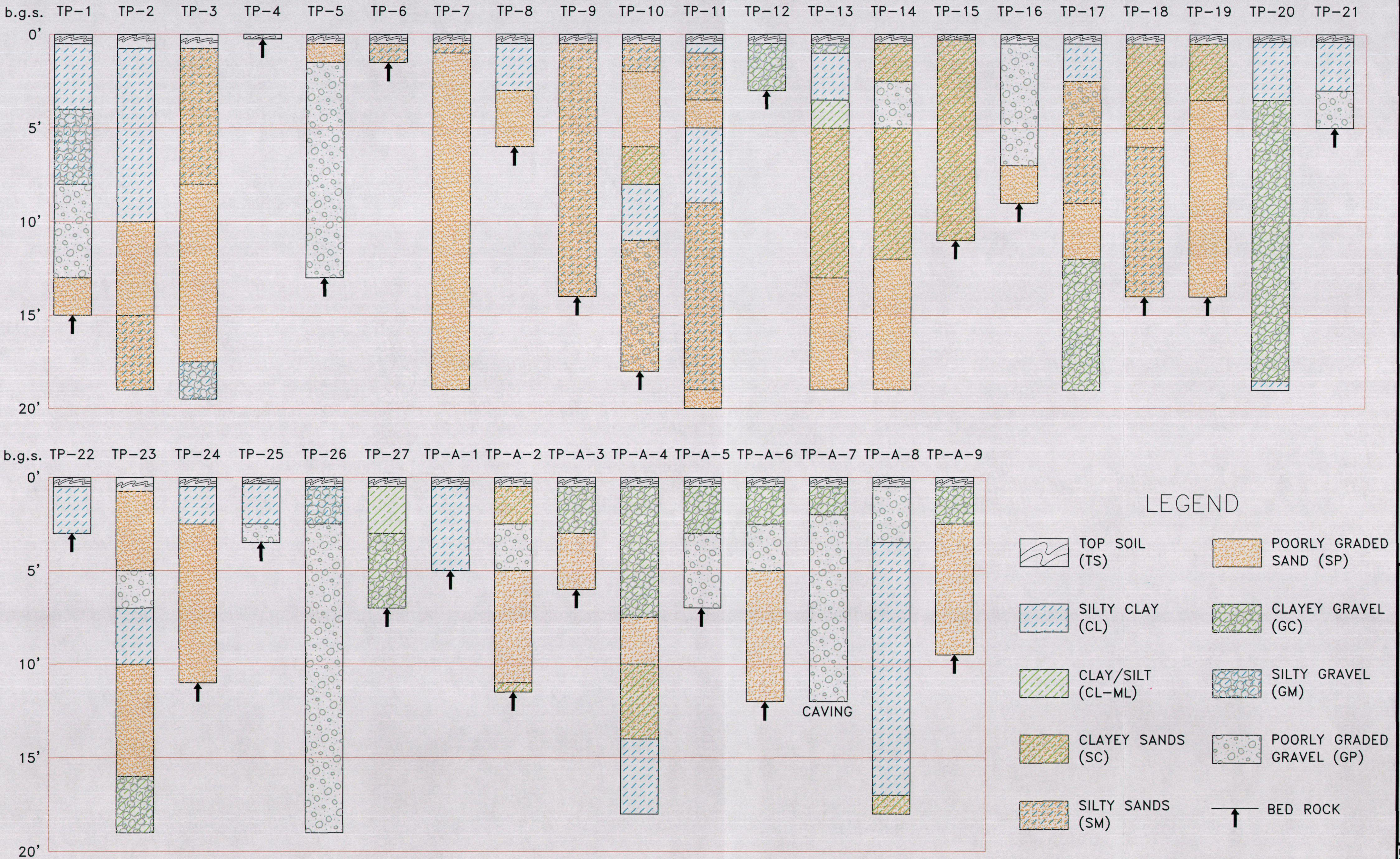
0 1/2 1

DRAWING IS NOT TO SCALE IF BAR DOES NOT MEASURE 1"

FIGURE:

3.1

3-2



REVISION | DATE | NO.

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0 1/2 1

PROMONTORY LANDFILL, LLC

PROMONTORY LANDFILL FACILITY
PROMONTORY LANDFILL DESIGN
TEST PIT LITHOLOGIES

AE2
ADVANCED ENVIRONMENTAL ENGINEERING
1975 N. MAIN, SUITE #3, LAYTON UTAH 84041
PHONE: 801.773.3155 FAX: 801.773.3156

DESIGN: DESIGN
DRAWN: DRAWN
CHECKED: CHECKED
DATE: DATE

0 1/2 1

DRAWING IS NOT TO SCALE IF BAR DOES NOT MEASURE 1"

FIGURE:
3.2
3-3

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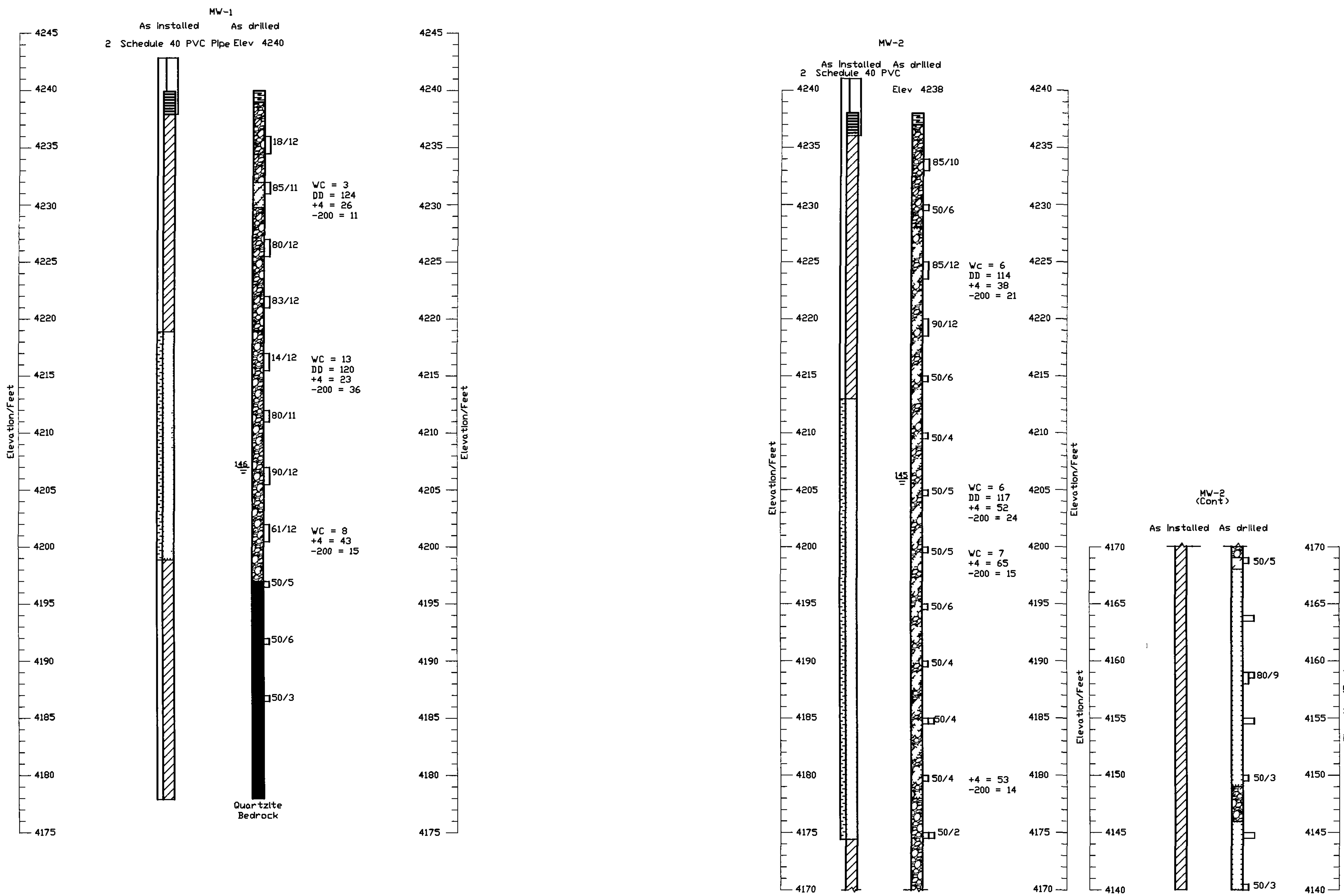
DRAWING SOURCE: AQUA ENGINEERING, INC.



REVISION

DATE

NO

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0 1/2 1

PROMONTORY LANDFILL, LLC

PROMONTORY LANDFILL FACILITY
PROMONTORY LANDFILL DESIGN
MONITORING WELL #1 AND WELL #2 WELL LOGS

ADVANCED ENVIRONMENTAL ENGINEERING
1975 N MAIN SUITE #3 LAYTON UTAH 84041
PHONE 801 773 3155 FAX 801 773 3156

DESIGN DESIGN
DRAWN DRAWN
CHECKED CHECKED
DATE DATE

FIGURE
3.3
3-4

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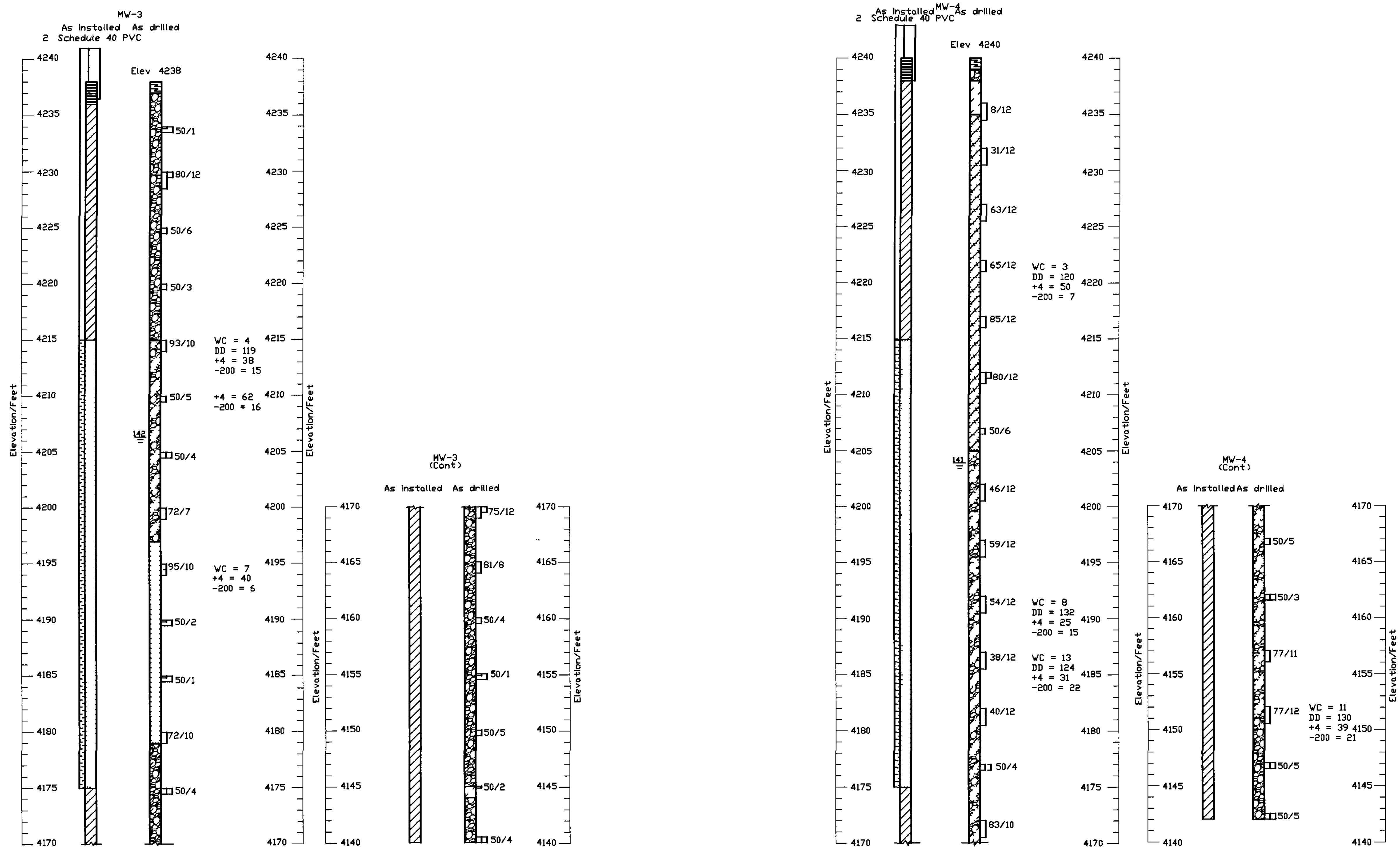
DRAWING SOURCE AQUA ENGINEERING, INC



REVISION	DATE	NO

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0 1/2 1

PROMONTORY LANDFILL, LLC

PROMONTORY LANDFILL FACILITY
PROMONTORY LANDFILL DESIGN
MONITORING WELL #3 AND WELL #4 WELL LOGS

ADVANCED ENVIRONMENTAL ENGINEERING
1975 N MAIN SUITE #3 LAYTON UTAH 84041
PHONE 801 773 3155 FAX 801 773 3156

DESIGN DESIGN
DRAWN DRAWN
CHECKED CHECKED
DATE DATE

FIGURE
3.4
3-5

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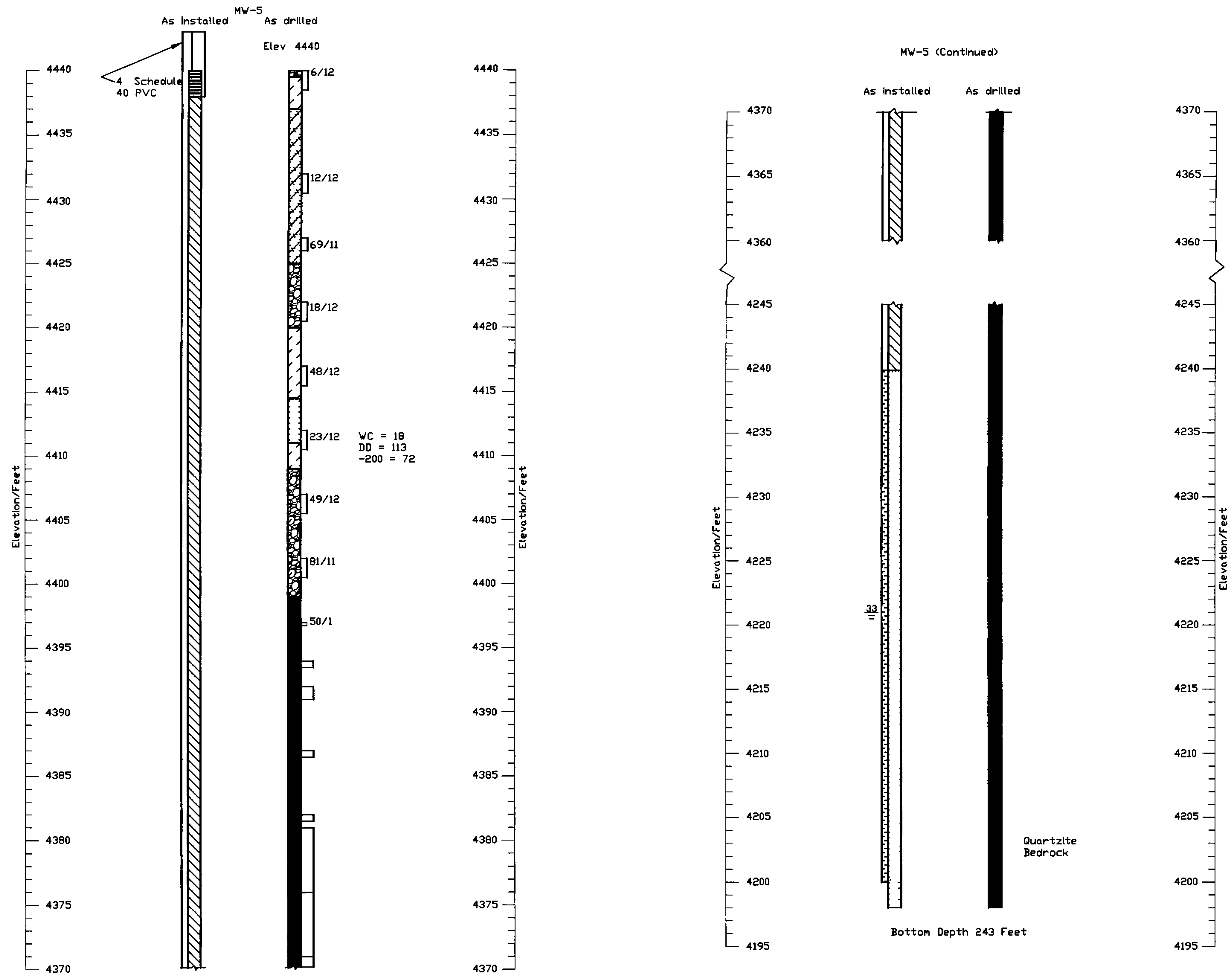
DRAWING SOURCE AQUA ENGINEERING, INC



REVISION	DATE	NO

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0 1/2 1

PROMONTORY LANDFILL, LLC

PROMONTORY LANDFILL FACILITY
PROMONTORY LANDFILL DESIGN
MONITORING WELL #5 LOGS

ADVANCED ENVIRONMENTAL ENGINEERING
1975 N MAIN SUITE #3 LAYTON UTAH 84041
PHONE 801 773 3155 FAX 801 773 3156

DESIGN DESIGN
DRAWN DRAWN
CHECKED CHECKED
DATE DATE

FIGURE
3.5
3-6

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DRAWING SOURCE AQUA ENGINEERING INC

remain stable while undergoing the predicted maximum earthquake accelerations The results indicated a 50 percent probability that deformation would exceed 15 cm for the proposed final cover design Some movement of the slopes can be expected during an event of this magnitude Friction angles for all the cover components shall be 25 degrees or greater, allowing the proposed cover design to be stable under both static and earthquake conditions

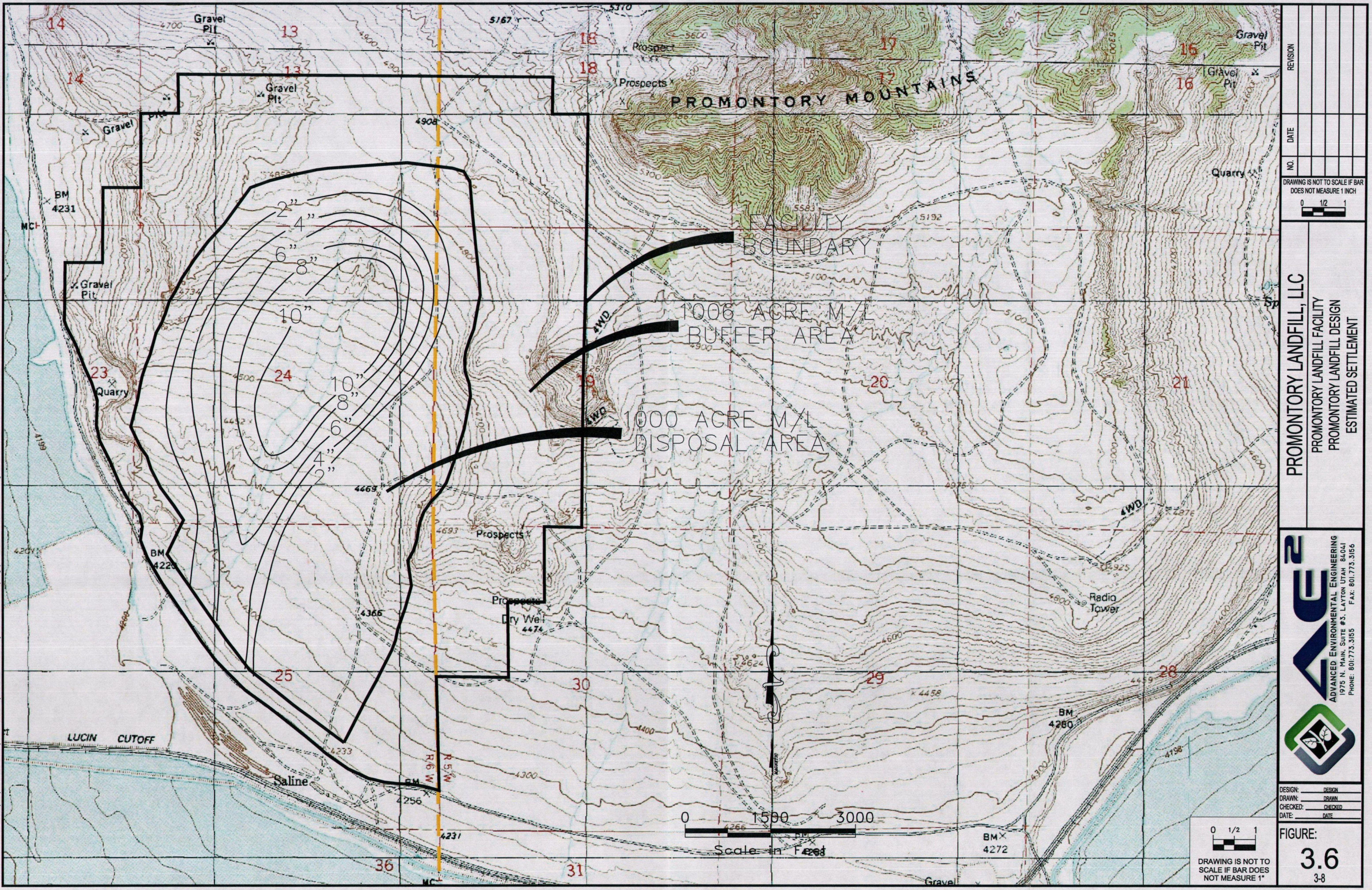
3 1 3 Settlement Calculations

Settlement calculations were performed for the proposed cell design Settlement calculations throughout the site ranged from 0-10 inches for the overburdened soil and 0-6 inches for bedrock strain These calculations were based on a final cover slope of 4 horizontal to 1 vertical and excavation and removal of the top 10 feet of site soil Figure 3 6 shows the total estimated settlement of the proposed cell

3 1 4 Geology

The Promontory Mountains are a part of the Basin and Range Province The province is made up of north/south elongated mountain blocks and valleys The Promontory Mountains form one of the mountain blocks in the province with the Great Salt Lake occupying a portion of the valleys on either side

The valleys were once occupied by a large lake known as Lake Bonneville during the Wisconsin Glacial period of the Pleistocene Age The present day Great Salt Lake is a remnant of ancient Lake Bonneville Stillstands of Lake Bonneville formed benches along the margins of the mountain blocks The highest level of Lake Bonneville is marked by a bench, the Bonneville shoreline, at approximate elevation 5280 feet The lake remained at this high level from approximately 17,000 to 15,000 years before present (B P) until it dropped approximately 350 feet during a catastrophic flood known as the Bonneville Flood (Currey and Oviatt, 1985 and Jarrett and Malde, 1987) Two lower stillstands of Lake Bonneville are the Provo



DRAWING SOURCE: AQUA ENGINEERING, INC.

(approximately 13,000 years B P) and Gilbert (approximately 10,000 years B P) which formed at approximate elevations 4930 and 4330 feet, respectively (Currey and others, 1983) The most recent high-water level, known as the Holocene High, occurred approximately 2,600 years B P with an approximate elevation of 4220 feet The site is at an elevation ranging from approximately 4230 feet to 5200 feet, placing the site between just above the Holocene High to just below the Lake Bonneville shoreline

3 1 5 Stratigraphy

The Quaternary sediments at the site consist predominantly of Lake Bonneville deposits with a thin veneer of alluvium and colluvium Bedrock in the area consists of Cambrian and Pre-Cambrian-aged rock (Crittenden, 1988)

The Quaternary sediments consist predominantly of sand and gravel representing primarily transgressive phases of Lake Bonneville shoreline deposits Some clay was encountered at the site, which generally represents deeper lake sediments deposited during the high stands of Lake Bonneville

Four bedrock formations have been mapped within the property boundaries The youngest of these deposits is the middle and lower Cambrian-aged limestone and shale consisting of interbedded, thin-bedded, medium-gray, limestone and olive-drab shale

The interbedded limestone and shale is underlain by lower Cambrian-aged Geertsen Canyon Quartzite, which consists of deep reddish-black hematitic quartzite

The Geertsen Canyon Quartzite is underlain by the late Proterozoic-aged Browns Hole Formation which consists of pale-gray, very-fine-grained, vitreous quartzite

The late Proterozoic-aged Mutual Formation underlays the Browns Hole Formation and consists of thick-bedded, coarse-grained quartzite intercalated with a few beds of siltstone and shale

3 1 6 Structure

Due to the age of the bedrock, the bedrock is highly faulted, fractured and deformed The attitude of beds varies significantly across the site The dip of beds northeast of the site is generally down toward the northeast with a dip angle ranging from 30 to 45 degrees

3 1 7 Tectonic Setting

The Promontory Mountains are bounded on the west by a fault known as the East Great Salt Lake Fault (Hecker, 1993) The fault is mapped to extend within approximately 800 feet west of the west edge of the property The East Great Salt Lake Fault is considered to have had movement within the Quaternary and possibly within the Holocene time period Quaternary slip rates for the East Great Salt Lake Fault are estimated to be on the order of 0 4 to 0 7 millimeters per year, which is approximately half the slip rate for the Wasatch Fault (Pechmann, 1987)

A recent study (Dinter and Pechmann, 1998) using seismic reflection methods found the East Great Salt Lake Fault to be approximately 2 miles west of the southwest edge of the property

3 1 8 Geologic Hazards

Geologic hazards reviewed for the project consist of surface fault rupture, ground shaking, landslide, debris flow, rockfall, subsidence, dam failure flood, mining activity, salt dome and salt bed

1 Surface Fault Rupture Hazard

As indicated above, the East Great Salt Lake Fault is estimated to extend within approximately 2 miles west of the southwest edge of the property There is no surface evidence of the fault based on a reconnaissance of the area The presence of the fault is based on seismic reflection surveys performed by Dinter and Pechmann at the Great Salt Lake

Based on the topography of the area, the East Great Salt Lake Fault would have relative movement down on the west We would not anticipate shallow bedrock to be encountered on the west side of the fault Based on this reasoning, the fault is located west of the road along the west edge of the property Surface fault rupture is not considered a hazard at the site

2 Earthquake Ground Shaking

Ground shaking due to large earthquakes in the area is a potential hazard at the site Studies performed by the U S Geological Survey would indicate that a probabilistic ground motion of 0 55g would have a 2 percent probability of occurrence in a 50-year period

3 Landslide

There are no mapped landslides on the property based on a review of the landslide map of the Promontory Point 30 minute by 60-minute quadrangle (Harty, 1992) Some landslides are mapped north of the site in Little Valley

Based on a reconnaissance of the site and the subsurface conditions encountered in the test pits excavated at the site, landslide is not considered a hazard for the proposed development

4 <u>Debris Flow</u>

There are no significant drainages, which extend through the site and no source for debris flow upgradient of the site Debris flow is not considered a hazard for the proposed development

5 <u>Rockfall</u>

The source of rock for rockfall is steep rock outcrops at Lead Mountain to the northeast of the site and minor rock cliffs and bedrock outcrops in the southeast portion of the site None of these rockfall sources are significant enough to pose a hazard for the proposed development

6 <u>Subsidence</u>

The overburden soil at the site generally has low compressibility characteristics The bedrock in the area consists predominantly of quartzite, which has low solubility The limestone, which is present in the northeast portion of the site, shows no evidence of caverns or other solution features of significance A reconnaissance of the site found no evidence of depressions or other subsidence features Subsidence due to dissolution of the limestone bedrock is not considered a potential hazard at the site

7 <u>Dam Failure Flooding</u>

There are no dams upgradient of the site Thus, dam failure flooding is not considered a hazard

8 <u>Mining Activity</u>

The Promontory Mountains have been mined for lead in the past There are mine prospects northeast of the site at and around Lead Mountain Gravel and riprap for construction of the railroad causeway have been mined in the northwest portion of the property There are some mine prospects in igneous dikes, which cut through the Mutual Formation in the northwest portion of the site Most mine prospects in the area appear to be shallow explorations with no evidence of significant underground mining due to the lack of mine spoil piles of significance Two mineshafts were identified by the Utah Division of Oil, Gas and Mining in 1986 just east of the gravel quarries in the northwest portion of the site Mine related hazards are not considered a concern for the proposed development

9 Salt Domes and Beds

Based on a reconnaissance of the site and subsurface exploration, there is no evidence of significant salt deposits on the property Salt deposits are not expected with the type of bedrock encountered at the site Salt domes and salt beds are not considered a hazard for the proposed development

3 2 GEOHYDROLOGY

3 2 1 Regional Geohydrology

"Precipitation on the Promontory Point Mountains area is estimated to average 240,000 acre-feet annually Of this amount, about 93 percent is consumed at or near the point of fall, because most of the precipitation falls on low altitude areas where the rate of precipitation is small, air temperatures are relatively high, and soil moisture requirements are high" (Hood, 1972)

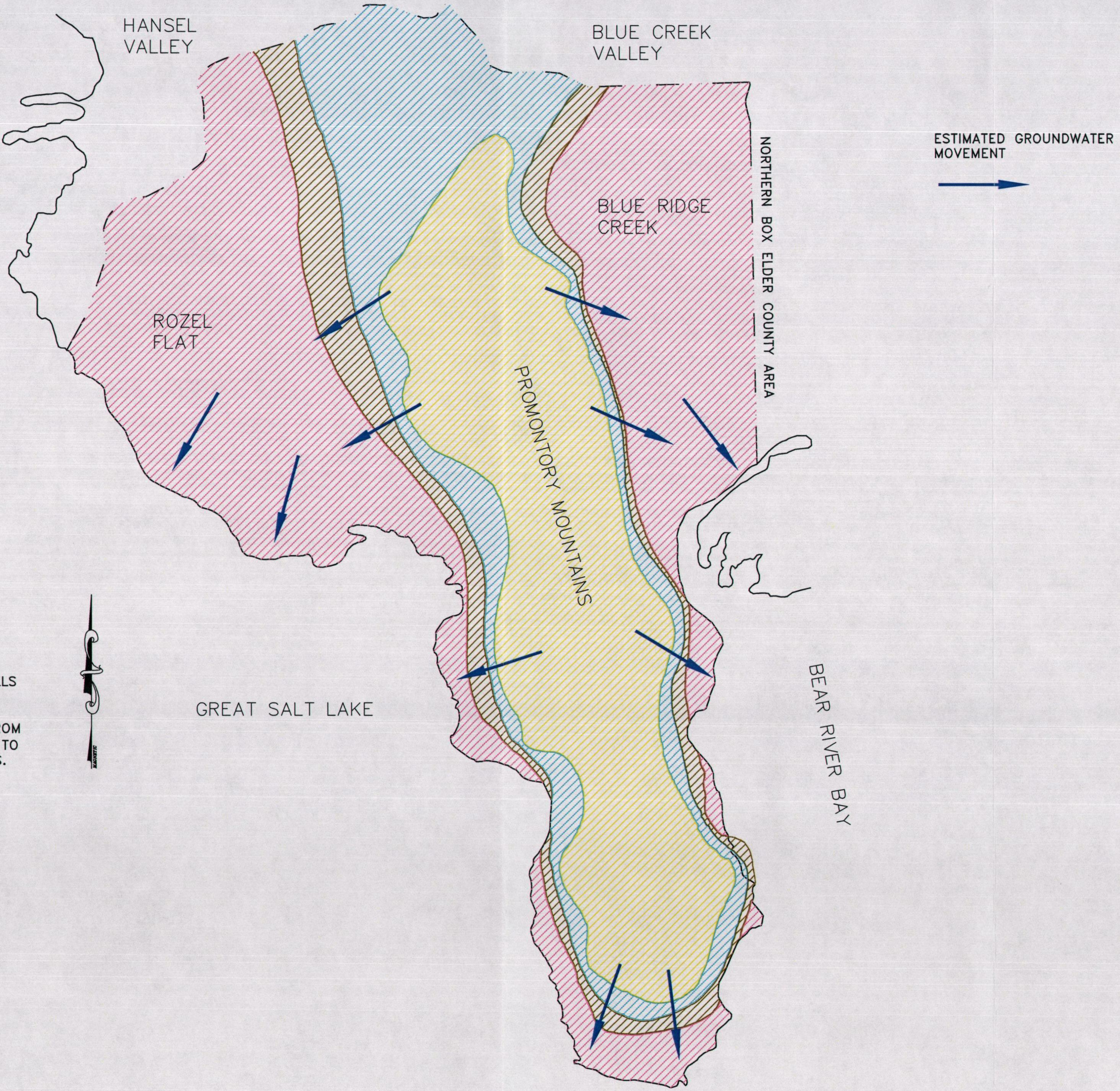
An estimated 5 percent of the total precipitation in the drainage area serves as recharge to the groundwater storage Only the higher elevations on Promontory Point receive amounts of precipitation that exceed the area's gross consumptive use to produce runoff The estimated annual direct runoff from the Promontory Point is 2,000 acre-feet

The quality of the groundwater is poor and is a critical limiting factor for future development The majority of the water from Promontory Point is very hard consisting of dissolved salt concentrations as high as 25,000 milligrams per liter The high salt concentration creates a hazard for irrigation The limited fresh water available on Promontory Point is obtained through wells and springs on the northern exposures of Promontory Mountains with salts concentrations as low as 300 milligrams per liter The primary use of water on Promontory Point is livestock watering

Fresh water for consumption will be supplied by bottled water Sewage generated at the site will be treated using a septic system Box Elder County has issued a letter stating that the site is suitable for septic systems Site water and fire suppression water will be obtained from water sources near the site It is anticipated that the facility will need 50,000 gallons per day of non-potable water for site water and fire suppression Above ground storage tanks will be used to maintain 20,000 gallons of water at all times Due to the stratigraphy and proximity to the Great Salt Lake, development of groundwater sources will be more than adequate

Groundwater in the Promontory Point area is not considered a discrete hydrologic unit It is most uniformly available from the rocks of Cenozoic age (Hood, 1972) These reservoirs of water consist in sedimentary rocks both consolidated and unconsolidated Other groundwater reservoirs are located in consolidated rock of the Paleozoic and Precambrian age The groundwater reservoirs in the consolidated rocks are thought to be connected hydraulically and receive flows from areas to the north

The aquifer is not considered as a sole source aquifer and the groundwater is not classified as a Class IB under Section R317-6-3 3 The general direction of groundwater movement is from the recharge areas westward toward the Rozel Flat and thence southward toward the Great Salt Lake Water is also thought to move eastward from the Promontory Point Mountains and southward from the Blue Creek Valley area toward Bear River Bay See Figure 3 7 for the general direction of groundwater movement



NOTE:
USING WATER ELEVATIONS AT MONITORING WELLS #4 AND #5, THE HYDRAULIC GRADIENT WAS CALCULATED AT 0.023 ft/ft. THE GROUND WATER FLOW RATE IS EXPECTED TO RANGE FROM 0.3 – 0.00001 gpm/ft sq AT THE SITE DUE TO THE VARIABILITY OF ROCK AND ALLUVIAL FILLS.

NO.	DATE	REVISION

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PROMONTORY LANDFILL DESIGN
GROUND WATER MOVEMENT

ADVANCED ENVIRONMENTAL ENGINEERING
1975 N. MAIN, SUITE #3, LAYTON UTAH 84041
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FIGURE:
3.7
3-15

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DRAWING SOURCE: AQUA ENGINEERING, INC.

3 2 2 Local Geohydrology

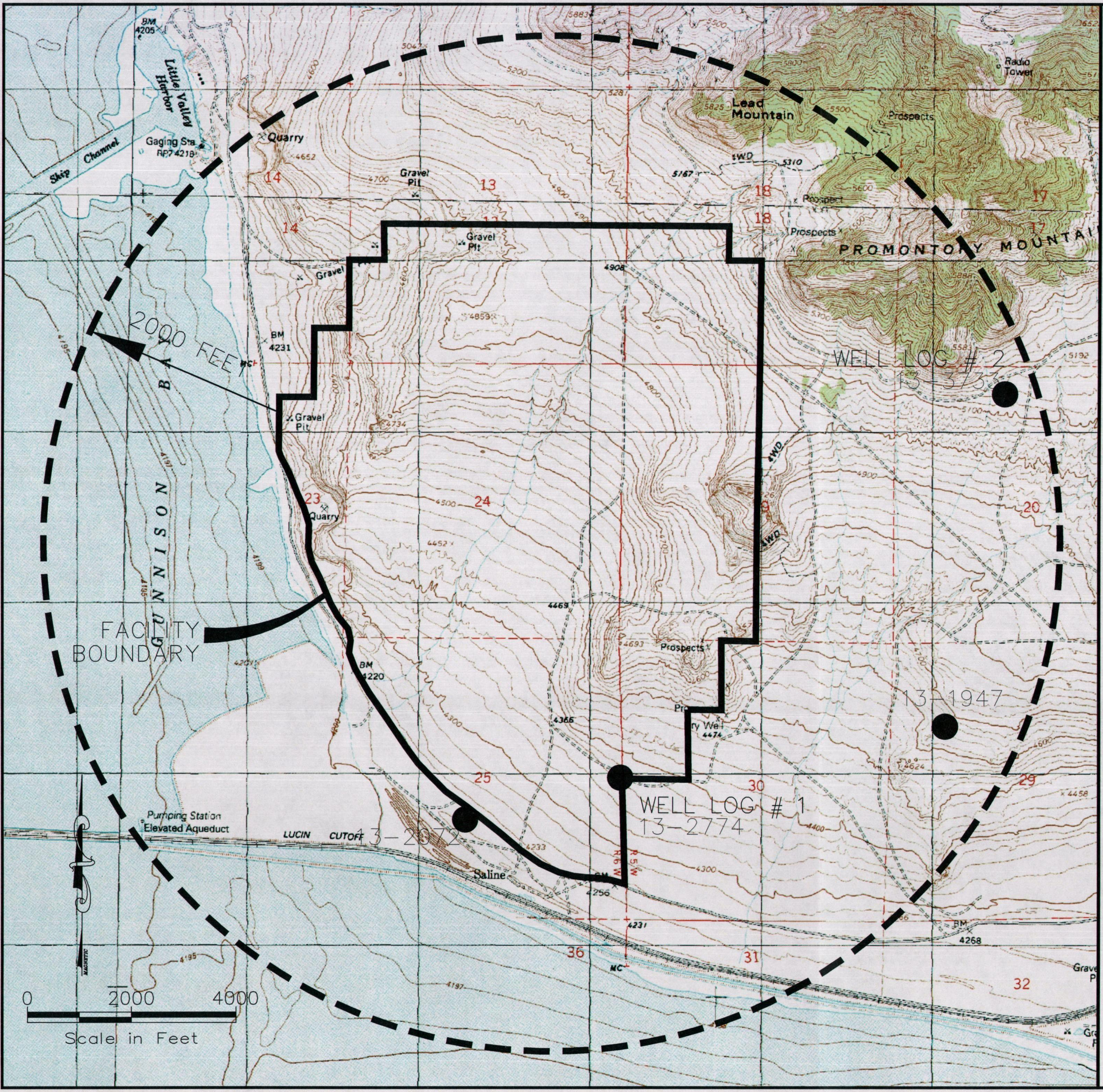
The depth to groundwater at the site ranges from 33-35 feet near the south end of the proposed facility, 250 feet near the center, and about 500 feet near the northern end of the facility Depth of groundwater throughout the site was estimated using information from the monitoring wells

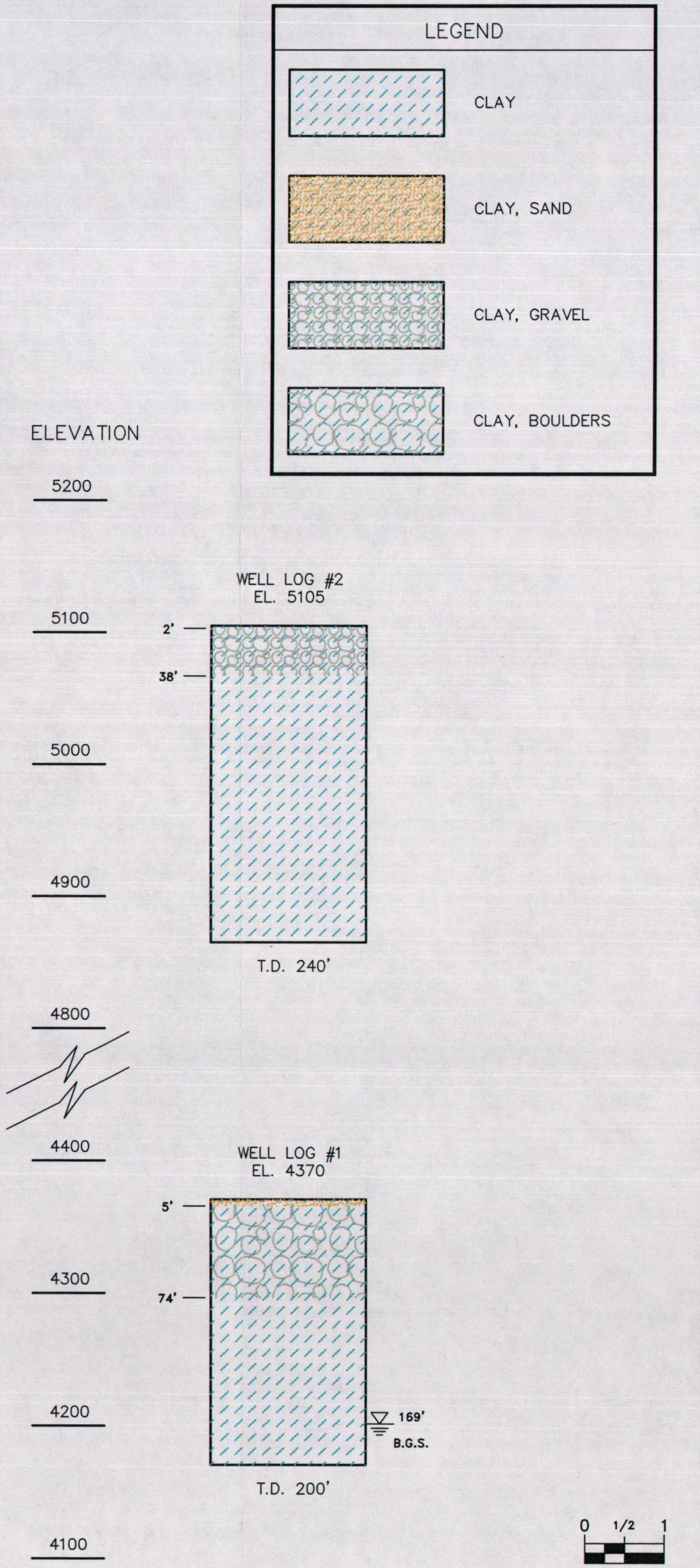
A water right search of the area surrounding the proposed Promontory Landfill Facility using the Utah Division of Water Rights database was initiated to identify proximate water right applications on file in the State Engineer's office Within 2000 feet of the facility boundary, four water rights were identified These water sources are shown on Figure 3 8 and the water right information is included in Appendix E

- Water right # 13-2072 point of diversion is described as 1900 feet north and 350 feet west of the south quarter corner of Section 25, Township 6 North, and Range 6 West, SLBM Little is know about the construction of the underground water well that has a priority starting in 1930 for livestock watering No well driller's report was available

- Water right # 13-2774 point of diversion is described as 2700 feet north and 100 feet west from the southeast corner of Section 25, Township 6 North, and Range 6 West, SLBM This 6 inch underground water well was completed in 1972, to a total depth of 200 feet Figure 3 4 details the cross sectional lithology and the reported 169 b g s to the static water table

- Water right # 13-1947 point of diversion is described as 1600 feet south and 1000 feet east from the northwest corner of Section 29, Township 6 North, Range 5 West, SLBM Priority for the water right dates back to 1930 Without a well drillers log, little is known about the underground water well





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PROXIMAL WATER RIGHTS

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FIGURE:
3.8
3-17

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DRAWING SOURCE: AQUA ENGINEERING, INC.

- Water nght # 13-3733 point of diversion is descnbed as 535 feet south and 2112 feet east from the northwest corner of Section 20, Township 6 North, Range 5 West, SLBM The underground well was abandoned after dnlling to a depth of 240 feet without encountenng water Figure 3 4 depicts information gathered from the well log

3 3 SURFACE WATER

There are no perennial streams located near the site Intermittent flows occur on the site and surrounding areas dunng times of rainfall or snow melt Most of storm runoff at the site is received from the hills to the north and northeast The nearest perennial stream is Blue Creek, located approximately 20 miles to the northeast, which flows most of the year and is fed by large spnngs discharging an estimated peak flow of 3 cubic feet per second

CHAPTER IV
ENGINEERING REPORT

4 1 REGULATORY CONFORMANCE

The engineering plans and specifications contained in this application have been developed to satisfy the regulations that have been set forth by the State of Utah and the EPA

4 2 DEVELOPMENT IMPACTS

Based on the effected environment, the proposed design, and the operational protocol, the Class I Landfill would have no significant impact to human health, safety, and the environment of the surrounding area including surface and groundwater resources

4 3 SITE INVESTIGATIONS

Both subsurface and surface investigations were conducted starting in December 2002 and concluded in July 2003 During this period a total of 36 test pits and 5 monitoring wells were constructed and an evaluation of wildlife and cultural resources was conducted Field notes from subsurface investigations are included in Appendix D Environmental and cultural resource studies are located in Appendix F

4 4 LOCATION STANDARDS

The Rules require that Class I Landfills comply with certain location standards These standards are intended to minimize potential impacts to surrounding lands, the environment, surface and groundwater resources, cultural and social resources, and human health Environmental and cultural resource studies along with comments from the United States Fish and Wildlife Service and the State of Utah Division of Natural Resources are included in Appendix F

4 4 1 Land Use Compatibility

The landfill and related facilities conform to the general location standards outlined in R315-302 Figures included within this Permit Application show the approximate west boundary of the disposal cell Prior to construction of disposal cells, a survey will be conducted to establish the high water level of 4212 The 4212 elevation will be transferred from the Saltair Marina located on the southern shores of the Great Salt Lake Once the high water level is established and transferred to the landfill facility, the modules will be adjusted accordingly to allow for a minimum 1000-foot distance from contour elevation 4212 Some of the location standards have been identified below

a The site is not located within a 1000 feet of a national, state or county park, monument, or recreational area, designated wilderness or wilderness study area, or wild or scenic river area

b The site is not located in an ecologically and scientifically significant natural area, including public wildlife management areas and habitat for threatened or endangered species as designated pursuant to the Endangered Species Act of 1982

c The site is not in farmland classified or evaluated as "prime," "unique," or of "statewide importance" by the U S Department of Agriculture Soil Conservation Service under the Prime Farmland Protection Act

d The site is not within a ¼ mile of any existing permanent dwellings, residential areas, and other incompatible structures such as schools or churches The nearest dwelling is several miles away

e A cave/rockshelter was located near the cell development area The Owner has selected to include the cave/rockshelter within the buffer area to ensure its preservation The Owner will not be mining of soils near the cave/rockshelter and will try to protect it from vandals by close observations See attached Figure 4 1 for general location

f The site is not within 10,000 feet of any airport runway used by turbojet aircraft or within 5,000 feet of any airport runway used by only piston-type aircraft A landing strip used by the brine shrimp operations is located approximately 8,000 feet southeast of the proposed landfill facility The landing strip is used primarily only during the brine shrimp harvest season

g The site is not within 1,000 feet of any public highway The nearest state highway is almost 16 miles from the proposed facility

h The site is not located on any public land that is being used by a public water system for municipal drinking water purposes The site is not located withm a watershed used by a water system

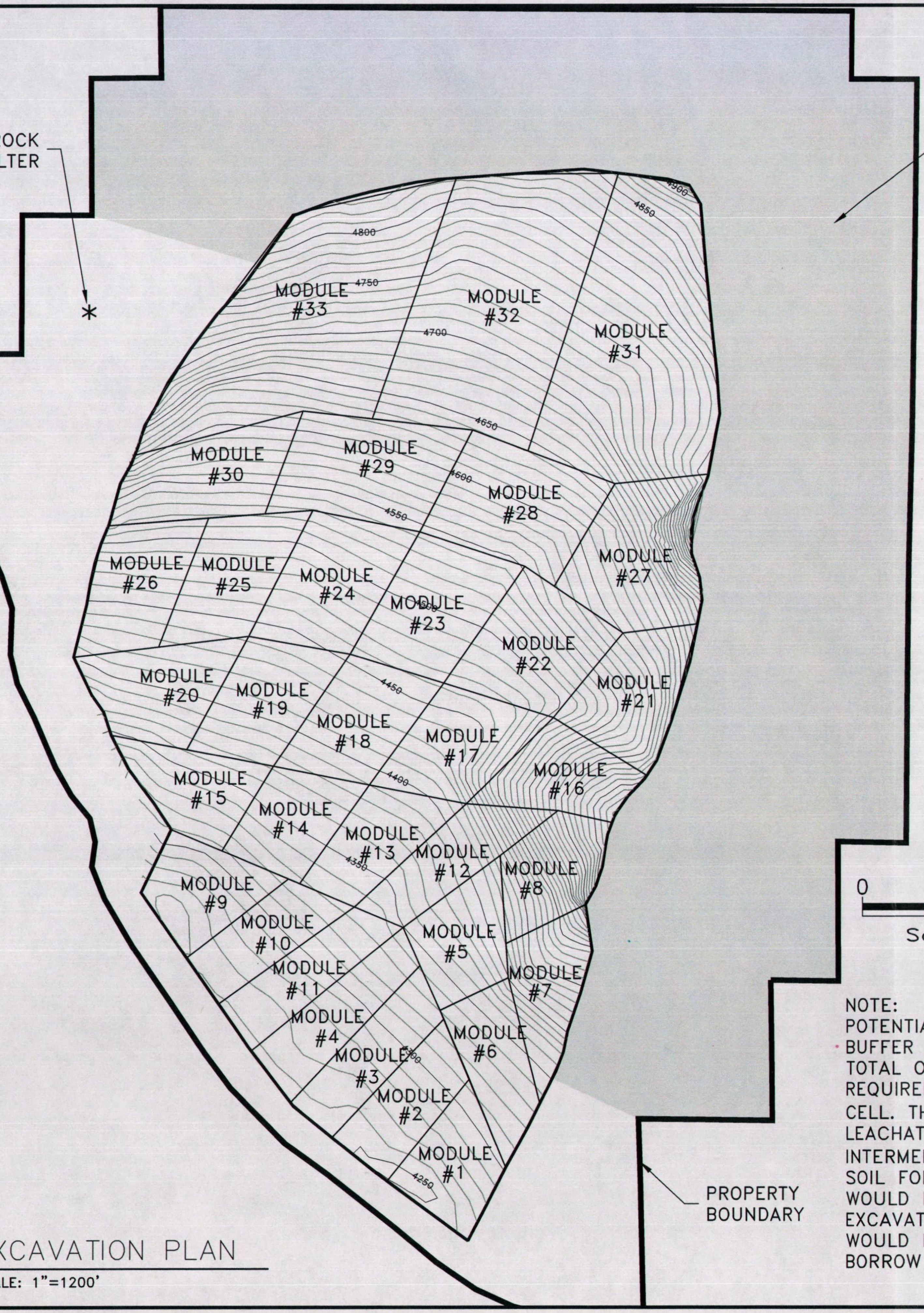
i The site is not located in a 100-year flood plain

j The site will not violate any applicable state water quality standard or section 307 of the Clean Water Act

k The site is not located in any wetlands and thus will not contribute to significant degradation of wetlands

4 4 2 Seismic Stability

The Regulations state that municipal landfills must be designed to withstand seismic accelerations if they are located in a seismic impact zone A seismic impact zone is defined as an area with a 10% or greater probability that the maximum horizontal acceleration in lithified material would exceed 0 10 g in 250 years According to



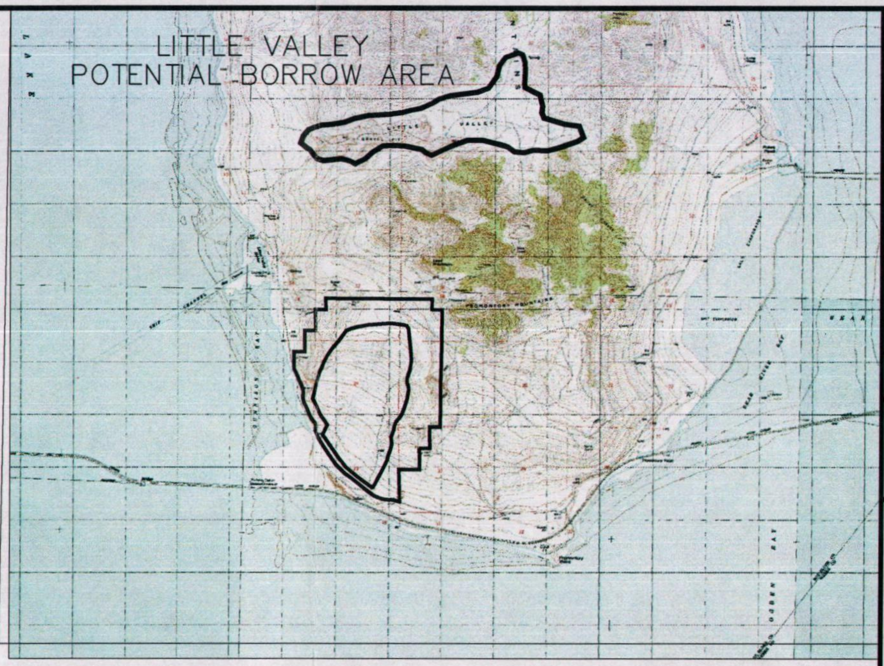
EXCAVATION PLAN

SCALE: 1"=1200'

0 1200 2400

Scale in Feet

NOTE:
POTENTIAL BORROW AREAS INCLUDE THE BUFFER ZONE AND LITTLE VALLEY. A TOTAL OF 30 MILLION YARDS WOULD BE REQUIRED FOR THE 1000 ACRE DISPOSAL CELL. THIS INCLUDES THE 24" GRAVEL LEACHATE COLLECTION SYSTEM, INTERMEDIATE COVER, AND 18" OF SITE SOIL FOR FINAL COVER. 14 MILLION YARDS WOULD BE OBTAINED FROM CELL EXCAVATION AND 17 MILLION YARDS WOULD BE OBTAINED FROM POTENTIAL BORROW AREAS.



MODULE NO.	ACRES	LIFE EXPECTANCY
1	20	2-3
2	20	3-4
3	20	2-3
4	20	2-3
5	20	3-4
6	20	3-4
7	20	2-3
8	20	2-3
9	20	2-3
10	20	2-3
11	20	3-4
12	20	3-4
13	20	5-6
14	20	5-6
15	20	4-5
16	20	2-3
17	25	5-6
18	25	5-6
19	25	5-6
20	25	3-4
21	25	2-3
22	30	4-5
23	30	5-6
24	30	5-6
25	25	4-5
26	25	3-4
27	35	2-3
28	35	5-6
29	35	5-6
30	30	3-4
31	85	4-5
32	90	5-6
33	90	4-5

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PROMONTORY LANDFILL, LLC
PROMONTORY LANDFILL FACILITY
PROMONTORY LANDFILL DESIGN
EXCAVATION PLAN

AE2
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FIGURE:
4.1

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DRAWING SOURCE: AQUA ENGINEERING, INC.

Blake, T F, et al (2002), there is a 10% probability of ground acceleration exceeding 0 55 g in a 250-year period at the landfill site The Promontory Landfill Facility is therefore located in a seismic impact zone The proposed cell has been designed to remain stable while undergoing the predicted maximum earthquake accelerations The results from AGEC Geotechnical and Geologic Study indicate that small to moderate displacement is likely under the seismic condition with predicted movement on the order of 15 centimeters for the 4 horizontal to 1 vertical slope Friction angles for cover components shall be 25 degrees or greater allowing the proposed design to be stable under both static and earthquake conditions

4 5 DESIGN APPROACH AND OBJECTIVES

The design approach for the proposed Class I Landfill was based on the Regulations, which state that the following factors shall be considered for the approval of a design

- Minimize liquids admitted in the landfill
- Design of a leachate collection system
- Liner design
- Cover design
- Gas control
- Any other relevant factors

Final construction plans and specifications, including quality control and quality assurance plans, must be approved by the Executive Secretary prior to the start of construction of any structure or feature of the landfill

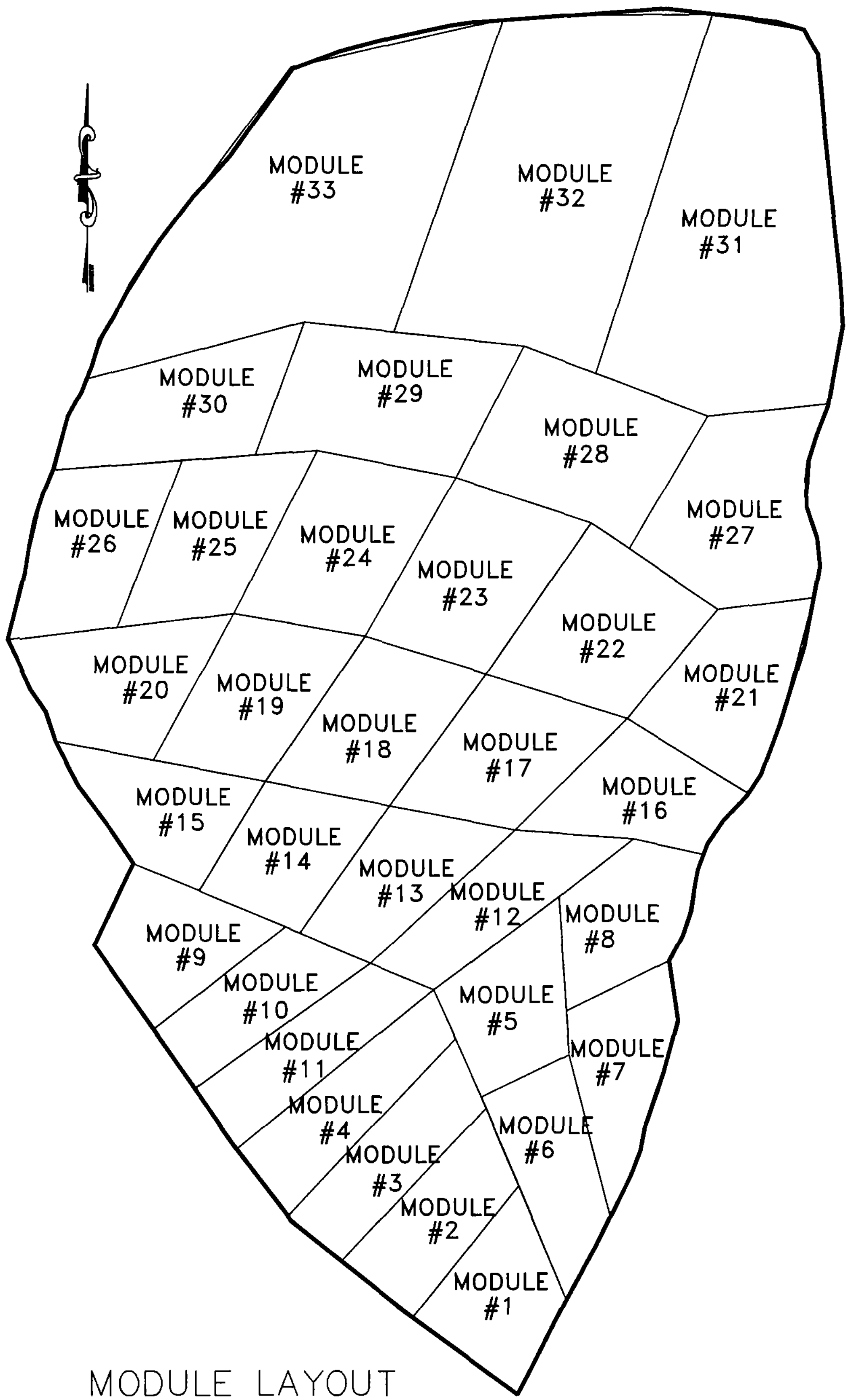
4 5 1 General Cell Design

The Class I disposal cell was designed to protect the waters of the state from degradation by pollutants or contaminants by maximizing evapotranspiration, minimizing percolation of water through the landfill, and diverting surface water run-on and run-off

The proposed disposal cell would be separated into modules as indicated on the excavation plan as previously shown on Figure 4 1 The life expectancy of each module is also indicated Figure 4 2 shows the module development plan using the area fill method of construction This method involves excavation of a defined area, installation of a liner, leachate collection system, select waste layer, and placement of refuse in conjunction with the installation of a gas collection system The module would consist of excavated slopes of 3 horizontal to 1 vertical and cover slopes of 4 horizontal to 1 vertical The liner components would be placed outside the proposed module area for future connection Select waste would exclude any items that may compromise the liner system Select waste is typically obtained from residential MSW collection Refuse would be placed in layers and compacted to minimize the potential for settlement A drainage berm would be constructed around the module to help divert run-on away from the refuse

The refuse would be covered daily with 6 inches of soil or with an Executive Secretary approved alternative daily cover Soil would be the primary means for daily cover and would be obtained from either exhumed soil from future modules or imported soils from the borrow areas or other near-by sites An estimated 30 million yards of soil would be required for the leachate piping gravel cover, intermediate cover, and an 18" layer of soil for the final cover An estimated 16 million yards would be obtained through cell excavation and the remaining 14 million yards through import from nearby borrow areas Gravel for the leachate piping and possible import fill could be obtained at or near the site in the surrounding gravel pits

An intermediate cover consisting of 12 inches of soil or an approved alternative would be applied to any working face not receiving waste for a period exceeding 30 days



MODULE LAYOUT

SCALE 1 =1200

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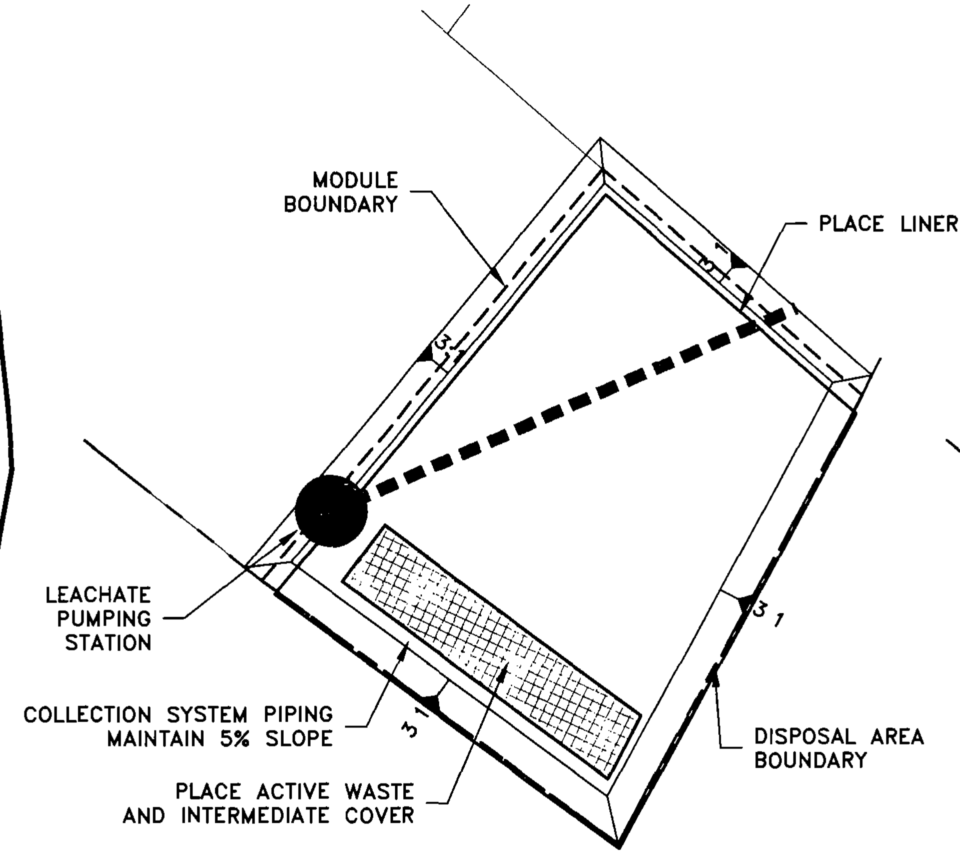
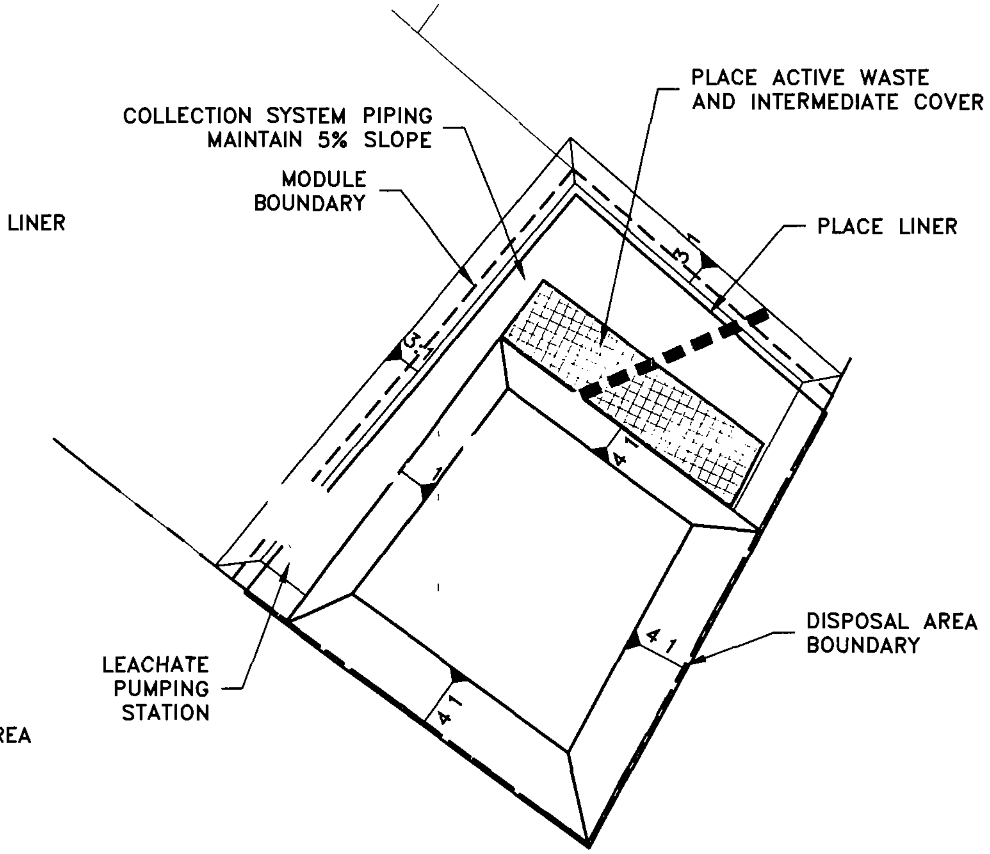
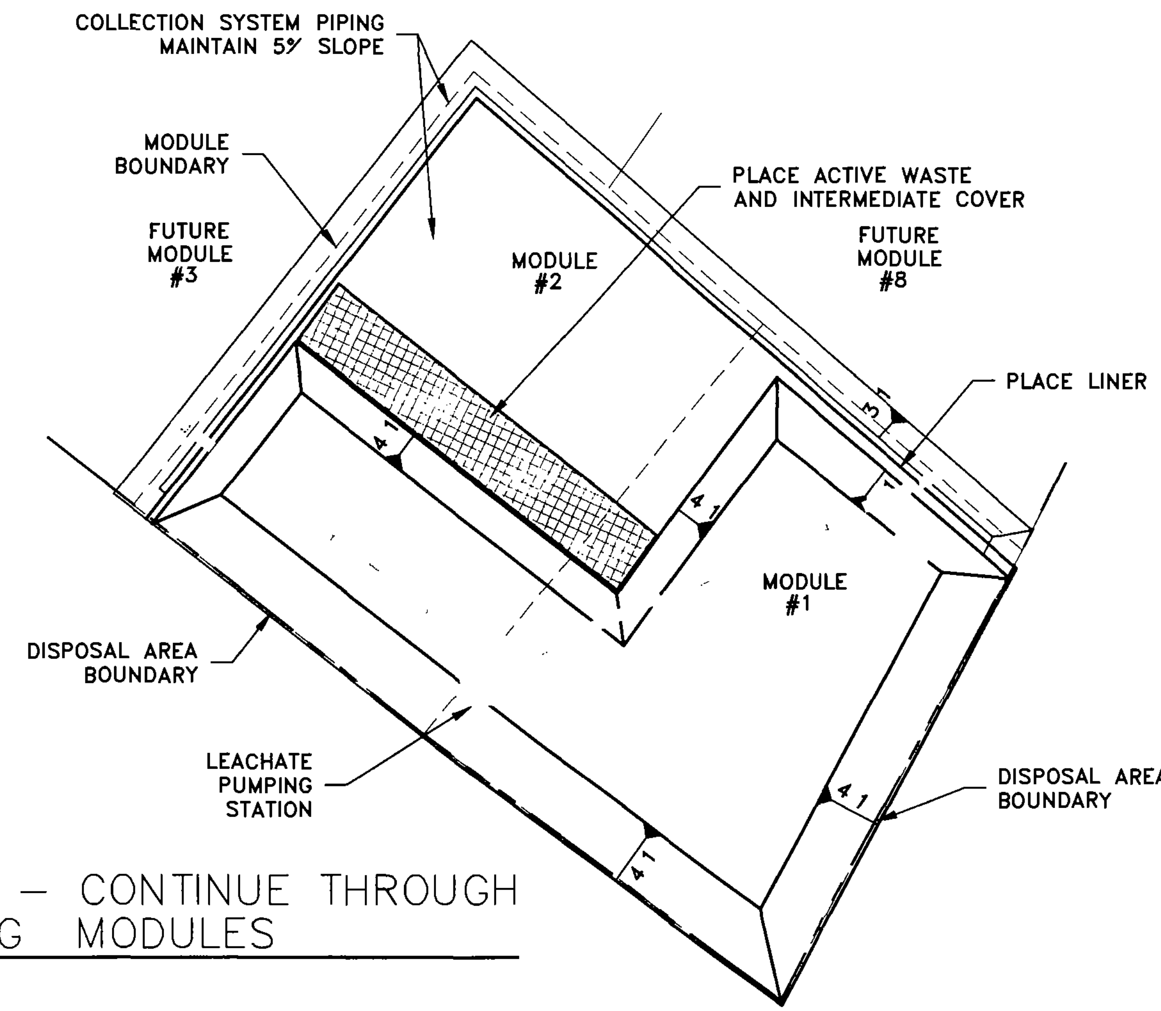
Scale in Feet



PHASE 1



PHASE 2



PHASE 3 – CONTINUE THROUGH REMAINING MODULES

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PROMONTORY LANDFILL, LLC

PROMONTORY LANDFILL FACILITY
PROMONTORY LANDFILL DESIGN
MODULE DEVELOPMENT PLAN

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DATE DATE

FIGURE
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4-7

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DRAWING SOURCE AQUA ENGINEERING INC

4 5 2 Liner

The liner system was designed to prevent pollutants and contaminants from escaping the landfill In order for the liner system to be successful it cannot leach or fail due to settlement, puncture, or seismic activity The liner would consist of a clay layer and a HDPE layer The clay layer would be placed on native soils, free of stones or other matter whose size and shape could puncture the clay layer A clay layer with specifications equivalent to or greater than the physical properties of Bentomat (ST) would be used See Appendix G for Bentomat (ST) specifications and a letter from the manufacturer certifying that the material would be able to perform properly under the conditions imposed by the Promontory Landfill design The HDPE layer would be 60 mil or thicker to minimize puncture risk The HDPE layer would be welded at all seams to provide containment A specification for a 60 mil HDPE liner can be found in Appendix G The HDPE would be protected from site soils by the clay layer The leachate collection system would consist of a geonet meeting specifications equal to or greater than the PermaNet UL Geonet manufactured by GSE See Appendix G for Specifications Overlaying the leachate collection layer would be a 20 oz/yd non-woven geotextile mat meeting specifications equal to or greater than the Ultra-Vera highly UV Stable Geotextile UV 1320 manufactured by Tenax Corporation See Appendix G for specifications The purpose of this mat is to separate the leachate collection system and the waste A protective layer (6-12 in) will be placed on top of the geotextile mat to protect the mat and geonet from protrusions and to also provide a buffering and filtration function The protective layer will consist of a homogenous material with an average particle size less than ½ inch diameter, and a maximum particle size less than 1 inch diameter

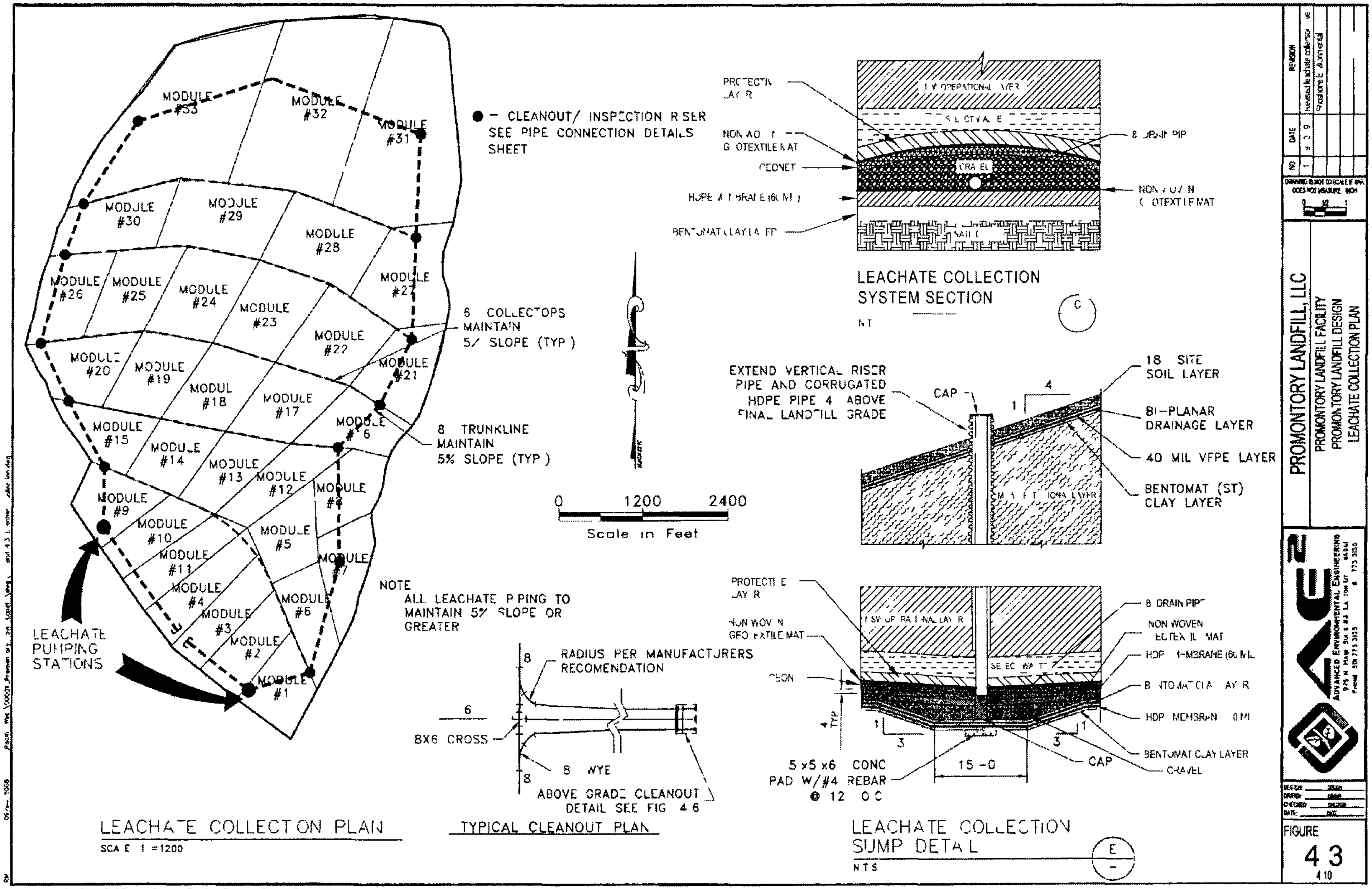
4 5 3 Settlement

Settlement calculations were performed for the proposed cell design Settlement calculations throughout the site ranged from 0-10 inches for the overburdened soil and 0-6 inches for bedrock strain These calculations were based on a final cover slope of 4 horizontal to 1 vertical and excavation and removal of the top 10 feet of site soil

4 5 4 Leachate Collection System

The proposed Class 1 Landfill would be equipped with a leachate monitoring and collection system as shown on Figure 4 3 The system is comprised of a network of drains which gravity flow to centrally located sumps positioned at the lowest points of the landfill cell Risers would be placed along critical areas of the main leachate trunk line for monitoring and maintenance The collection system would be constructed with perforated drainpipe encased within a 24" gravel layer overlain by a geotextile mat for separation between the MSW and leachate collection system The collection system piping would be designed to handle the specific site loading conditions See Appendix G for a letter from fiberglass piping manufacturer as to the ability of pipe to perform under high loadings To help protect the collection system, the gravel protection layer would be thickened near the sumps Leachate would be pumped on an as-needed basis to maintain a level of less than 1 foot of leachate over the liner system Sump areas would be constructed as indicated on Figure 4 3 The removed leachate would either be use as a suppressant for fugitive dust and compaction water on areas of the landfill that are overlaid by an approved liner system or pumped to evaporation basins Evaporation basins will be permitted by the Utah Division of Water Quality Cleaning of the leachate collection system would be conducted on an as needed basis

The collection system was designed by quantifying the amount of leachate generated for the entire 1000-acre disposal cell Further information about the modeling will be



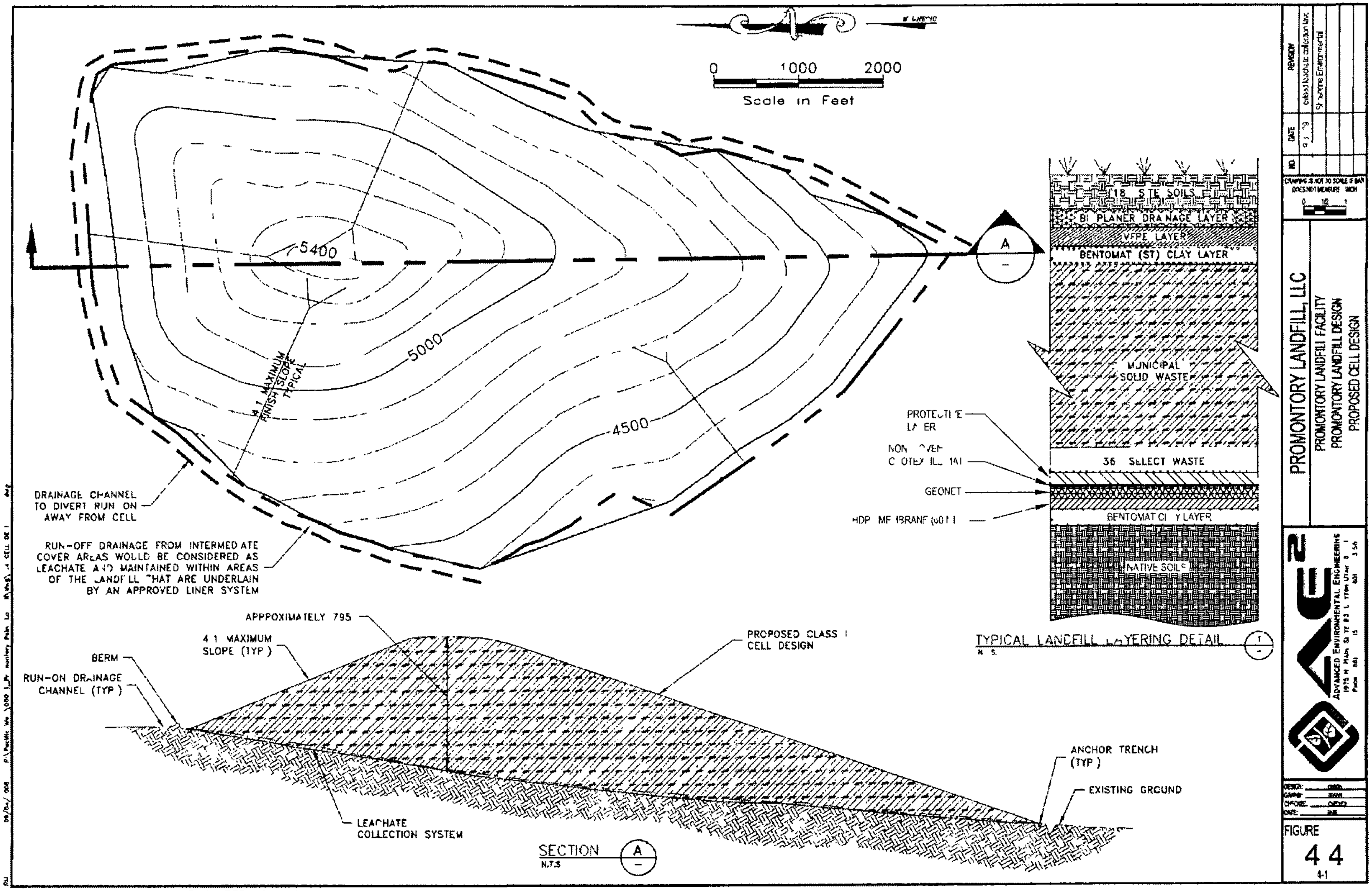
DRAWING SOURCE AQUA ENGINEERING INC

REVISED BY SHOSHONE ENVIRONMENTAL 9-30-09 presented in the site balance section of this chapter Calculations for determination of collection system placement and output files are included m Appendix H

4 5 5 Final Cover

The disposal cell was designed to eliminate infiltration through the cover to prevent the generation of leachate This was accomplished by promoting drainage and evapotranspiration from the cover, and by preventing percolation of precipitation into the disposal cell The proposed final cover would consist of the following layers (or equal), Bentomat (ST), 60 mil textured VFPE, Bi-planar Fabricap Geocomposite with 6 oz Geotextile bonded to both sides, and eighteen inches of site soils See Appendix G for sample specifications The final cover would be graded as shown in Figure 4 4 Materials for the final cover will be acquired by cell excavation or imported from nearby borrow areas The waste surface would be prepared so as to be free of irregularities, protrusions, vegetation, excessive water, loose soil or abrupt changes in grade The surface would not contain stones or other matter of such composition, shape, or size, which may be damaging to the geomembrane as specified by the manufacturer The anchor trenches for the cover and liner would be constructed to the lines, widths, and depths recommended by the geomembrane manufacturer The trench would be free of irregularities, protrusions, etc to avoid damage to the membranes Backfill operations would be conducted when the geosynthetic matter is at its most contracted state to prevent bridging The fill material would be placed in a manor to prevent damaging the membrane and compacted to 85% max dry density per ASHTO T-99

Drainage channels would be constructed around the cell as indicated by the drawings to help prevent erosion and divert any run-on and run-off in a controlled manner Berms would be placed and used as needed



DRAWING SOURCE AQUA ENGINEERING INC REVISED BY SHOSHONE ENVIRONMENTAL 9-30-09

4 5 6 Landfill Gas Collection System

The preliminary landfill gas collection system (LGCS), shown on Figure 4 5 would be implemented to eliminate potential problems associated with landfill gas including subsurface lateral migration, odor, and release of methane Gas Collection and management would need to be reviewed and approved by the Division of Air Quality prior to construction of the system

Landfill gases typically consist of approximately 50% methane and 50% carbon dioxide and were modeled as such Landfill Gas Emissions Model version 2 1 (EPA) was used to model gas generation The parameters used in the model were default parameters specified by the Environmental Protection Agency (EPA)

According to the Utah Department of Air Quality, this model typically overestimates gas production in this region when default arid climate parameters are used This is evident in Table 4 1, which shows over a magnitude of difference in the emissions rate using the default EPA parameters versus parameters used in the Salt Lake Valley Solid Waste Management Facility Permit Application Salt Lake Valley Solid Waste Management Facility's parameters were used because of the facilities close proximity and similar environmental setting The output files using these default parameters are included in Appendix I

TABLE 4 1
VALUES USED FOR LANDFILL GAS COLLECTION SYSTEM

Description	Lo (m^3/Mg)	K (1/yr)	NMOC (ppmv)	NMOC Emissions Rate (Mg/yr)
EPA Default	170	0 02*	4000	1 96E+04
Salt Lake Valley	169 9	0 02*	300	1 46E+03

* Value accounts for arid regions

NMOC Nonmethane Organic Compounds

ppmv Parts per million by volume

Lo Generation Potential (amount of methane generated by a given amount of refuse)

K Decay Rate (exponential rate of decomposition)

The landfill gas collection system was conservatively designed using the emissions rate generated for EPA default parameters The active gas collection system would be put into service when NMOC emissions at the site were to exceed 50 Mg/yr (55 tons/yr) or concentrations of methane gas were to exceed the lower explosive limit at the property boundaries This is estimated to take place between 8 to 9 years after operations start Extraction wells and collection piping would be strategically placed for effective gas collection

4 6 SITE WATER BALANCE

Hydrologic modeling of the Class 1 disposal cell was performed in order to assess the water balance for a closed case

4 6 1 HELP Modeling Parameters

The hydrology of the disposal cell was predicted using the computer model Hydrologic Evaluation of Landfill Performance (HELP), Version 3 07 for a open and closed cell case Modeling of the cell was performed to design the leachate collection system, evaporation basin, and to determine the infiltration through the final cover

HELP calculates the water balance for the proposed cell based on cell design and climatic conditions Cell design consists of soil and waste layer thickness, hydraulic conductivity of each layer, percent of total area where run-off could occur, and other characteristics of the proposed cell design

Based on the 30-year average daily temperature, precipitation, and monthly solar radiation, HELP calculates the water balance for the site that includes evapotranspiration, run-off, percolation, and change in water storage of the subsurface soils The average annual precipitation for the period of record is 13 36 inches of which 12 97 inches are consumed through evapotranspiration
The climatic data used was taken from the weather station at Bear River Migration Bird Refuge located approximately 26 miles northeast of the proposed landfill facility A comparison was made for the data from a period between 1947 and 1984 and the average monthly data By making a comparison between the yearly data and average data, a year was chosen to represent the average year The year 1975 was used for precipitation and 1971 was used for temperature The average recorded precipitation for the site is 12 65 inches and the model used 13 36 inches The average recorded site temperature is 50 15 °F and was modeled with 49 86 °F

Open Cell Case for the Entire Site

The assumed profile for the open cell case consisted of 19 layers These layers included a total of nine 12 inches layers of site soils simulating daily cover (1 2 E-4 cm/sec), a total of nine MSW (1 0 E-3 cm/sec) layers of a thickness of 15 feet, and a single 24 inch layer of gravel for the leachate collection and protection layer (1 cm/sec) The evaporative zone was assumed to be 12 inches and the model ran for thirty years

The following assumptions and data were also used in the model The assumptions are considered conservative for the application of the model Table 4 2 lists the soil values that were used in the analysis

- Evaporative zone depth = 12 inches
- SCS runoff curve number = 83 (poor condition open space between Group B and C, over the life expectancy of the cell, it has naturally revegetated to 50% grass cover)

TABLE 4 2
SOIL VALUES USED FOR THE OPEN CELL CASE

Layer	Thickness (inches)	Zone Description	Total Porosity	Field Capacity	Wilting Point	Saturated Hydraulic Conductivity (cm/sec)
1	12	Daily Cover	0 398	0 244	0 136	1 0 E-5
2	180	MSW	0 671	0 292	0 077	1 0 E-3
3	12	Daily Cover	0 398	0 244	0 136	1 0 E-5
4	180	MSW	0 671	0 292	0 077	1 0 E-3
5	12	Daily Cover	0 398	0 244	0 136	1 0 E-5
6	180	MSW	0 671	0 292	0 077	1 0 E-3
7	12	Daily Cover	0 398	0 244	0 136	1 0 E-5
8	180	MSW	0 671	0 292	0 077	1 0 E-3
9	12	Daily Cover	0 398	0 244	0 136	1 0 E-5
10	180	MSW	0 671	0 292	0 077	1 0 E-3
11	12	Daily Cover	0 398	0 244	0 136	1 0 E-5
12	180	MSW	0 671	0 292	0 077	1 0 E-3
13	12	Daily Cover	0 398	0 244	0 136	1 0 E-5
14	180	MSW	0 671	0 292	0 077	1 0 E-3
15	12	Daily Cover	0 398	0 244	0 136	1 0 E-5
16	180	MSW	0 671	0 292	0 077	1 0 E-3
17	12	Daily Cover	0 398	0 244	0 136	1 0 E-5

18	180	MSW	0 671	0 292	0 077	1 0 E-3
19	24	Protection Layer	0 397	0 032	0 013	1

Closed Cell Case for the Entire Site

The assumed profile for the closed cell case consisted of 18 inches of site soil (1 0 E-5 cm/sec) overlaying 0 23 inches of fibricap (33 cm/sec), overlaying 0 23 inches of a textured VFPE (4 0 E-13 cm/sec), and overlaying 0 23 inches of Bentomat (ST) (3 0 E-9 cm/sec) The evaporative zone was assumed to be 18 inches and modeled for a period of thirty years

The following assumptions and data were also used in the model The assumptions are considered conservative for the application Table 4 3 lists the soil values that were used in the analysis

- Evaporative zone depth = 18 inches
- SCS runoff curve number = 79 (natural desert landscape Group C, cell has been fully re-vegetated)

TABLE 4 3
SOIL VALUES USED FOR THE CLOSED CELL CASE

Layer	Thickness (inches)	Zone Description	Total Porosity	Field Capacity	Wilting Point	Saturated Hydraulic Conductivity (cm/sec)
1	18	Evaporation	0 501	0 284	0 135	1 0 E-5
2	0 23	Drainage	0 85	0 01	0 005	33
3	0 23	VLDPE	0 0	0 0	0 0	4 0 E-13
4	0 23	Bentomat (ST) Clay Layer	0 75	0 747	0 4	3 0 E-9

Note The VLDPE was modeled assuming a pinhole density of 1-pinhole/acre and installation defects of 3-pinholes/acre The quality of installation was modeled as good

Leachate Collection System and Evaporation Basins

The profile used to estimate leachate generation consisted of 12 inches of daily cover (1 0 E-5 cm/sec), overlaying 15 feet of MSW (1 0 E-3 cm/sec), and overlaying a 24-inch protection layer (1 cm/sec) The evaporative zone was assumed to be 12 inches and model ran for thirty years

The following assumptions and data were also used in the model The assumptions are considered conservative for the application of the model Table 4 4 lists the soil values that were used in the analysis

- Evaporative zone depth = 12 inches
- SCS runoff curve number = 92 (poor condition barren surface, no vegetation on daily cover)

TABLE 4 4
SOIL VALUES USED SIZING THE EVAPORATION BASIN

Layer	Thickness (inches)	Zone Description	Total Porosity	Field Capacity	Wilting Point	Saturated Hydraulic Conductivity (cm/sec)
1	12	Daily Cover	0 398	0 244	0 136	1 0 E-5
2	180	MSW	0 6710	0 292	0 077	1 0 E-3
3	24	Protection Layer	0 397	0 032	0 013	1

4 6 2 HELP Modeling Results

Open Cell Case for the Entire Site

Table 4 5 summarizes the results of the cover analysis The modeling results indicate that no leachate would reach the leachate collection system This can be attributed to the site's low precipitation, high evaporation, and relatively deep fills

TABLE 4 5
RESULTS FOR THE OPEN CELL CASE

Description	Results
Precipitation	13 36 inches/year
Runoff	0 027 inches/year
Evapotranspiration	13 24 inches/year
Percolation/Leakage	0 08 inches/year
Peak Percolation/Leakage	0 0008 inches/day

To facilitate a more detailed analysis, printouts of the HELP model Outputs results are also included in Appendix H

Closed Cell Case for the Entire Site

Table 4 6 summarizes the results of closed cell case used to evaluate the cover design The model only considered the cover design

TABLE 4 6
RESULTS FOR THE CLOSED CELL CASE

Description	Results
Precipitation	13 36 inches
Runoff	1 314 inches/year
Evapotranspiration	12 022 inches/year
Lateral Drainage	0 00786 inches/year
Percolation/Leakage	0 inches/year

The results indicate the total percolation through the proposed 1000-acre cover using 4 pinholes per acre is 1 1 gallons per year To facilitate a more detailed analysis, printouts of the HELP model Outputs results are also included in Attachment H

Leachate Collection System and Evaporation Basins

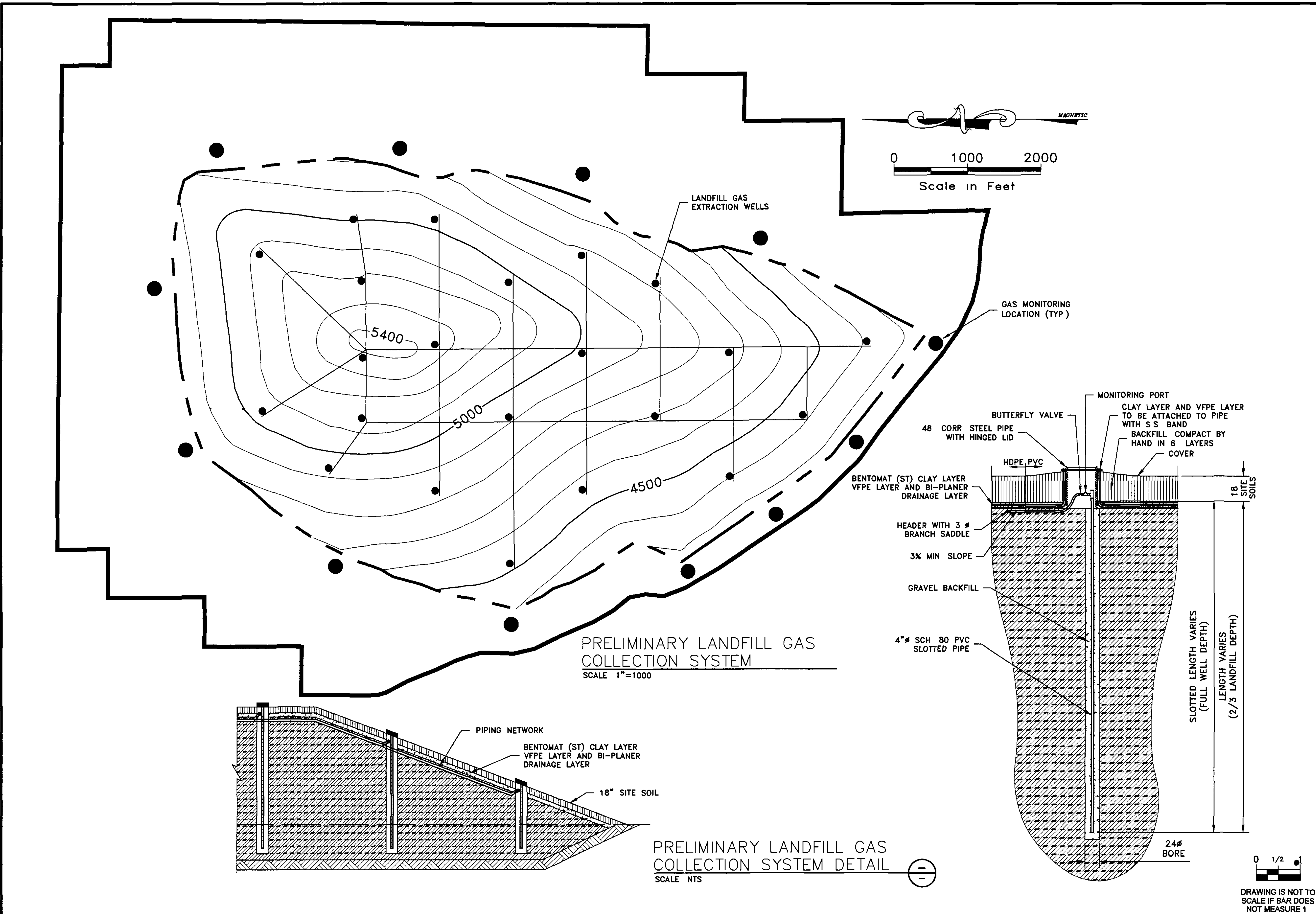
Table 4 7 summarizes the average monthly values of leachate generated on a per month basis

TABLE 4 7
MONTHLY LEACHATE GENERATION

Month	Results
January	0 01 inches
February	0 01 inches
March	0 01 inches
April	0 01 inches
May	0 00 inches
June	0 00 inches
July	0 02 inches
August	0 02 inches
September	0 02 inches
October	0 02 inches
November	0 01 inches
December	0 01 inches

Using 0 02 inches from August's results and a twenty-acre collection area, the gravel layer would need to flow 0 24 gpm for the entire 20 acres or 2 8 E-7 gpm per square foot Using the proposed ¾" aggregate mix design for the bottom 1 foot of the gravel layer, with a permeability of 1 cm/sec, the flow rate using Darcy's Law is 0 74 gpm per square foot The maximum subrounded aggregate of ¾" allowing for a factor of safety of 3 for geomembrane puncture Calculations are provided in Appendix H

The monthly leachate calculated from module 1 was used m a mass balance calculation to determine the size requirements for a leachate evaporation basin The mass balance accounted for leachate generation as shown in Table 4 7, precipitation, and evaporation from a free water surface The first evaporation basin would be sized greater than 900 ft^2 with additional evaporation basins being constructed as required to accommodate future module development Detailed calculations are included in Appendix H Figure 4 6 and 4 7 show details for the Evaporation Basins



09/04/2008 P:\Pacific West\00001_Promontory Point Landfill\dwg\4 5_GAS COLLECTION SYSTEM 4-1 dwg

RM

REVISION	DATE	NO

DRAWING IS NOT TO SCALE IF BAR DOES NOT MEASURE 1 INCH

0 1/2 1

PROMONTORY LANDFILL, LLC

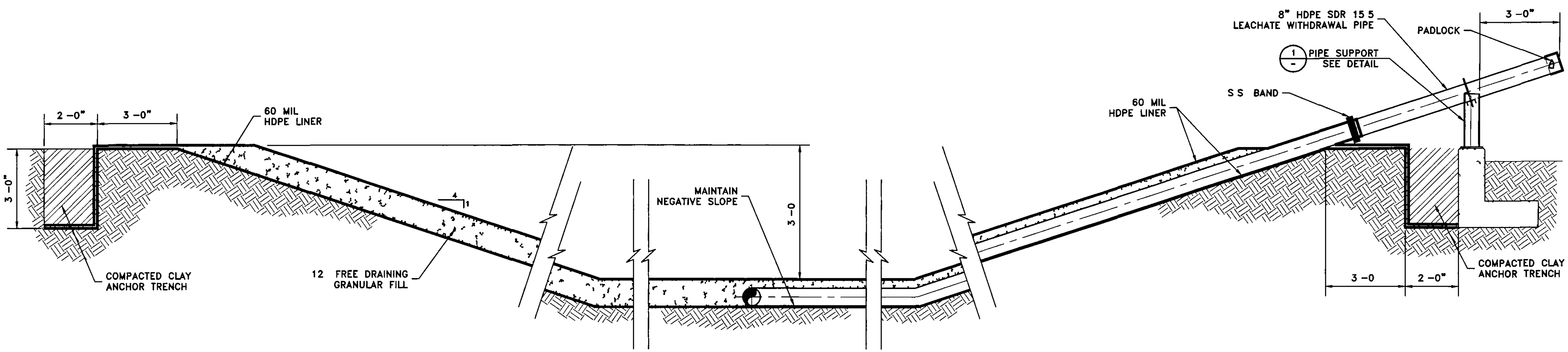
PROMONTORY LANDFILL FACILITY
PROMONTORY LANDFILL DESIGN
LANDFILL GAS COLLECTION SYSTEM

ADVANCED ENVIRONMENTAL ENGINEERING
1975 N MAIN SUITE #3 LAYTON UTAH 84041
PHONE 801 773 3155 FAX 801 773 3156

DESIGN DESIGN
DRAWN DRAWN
CHECKED CHECKED
DATE DATE

FIGURE
4.5

DRAWING SOURCE AQUA ENGINEERING INC



NO	DATE	REVISION

DRAWING IS NOT TO SCALE IF BAR DOES NOT MEASURE 1 INCH

0 1/2 1

PROMONTORY LANDFILL, LLC

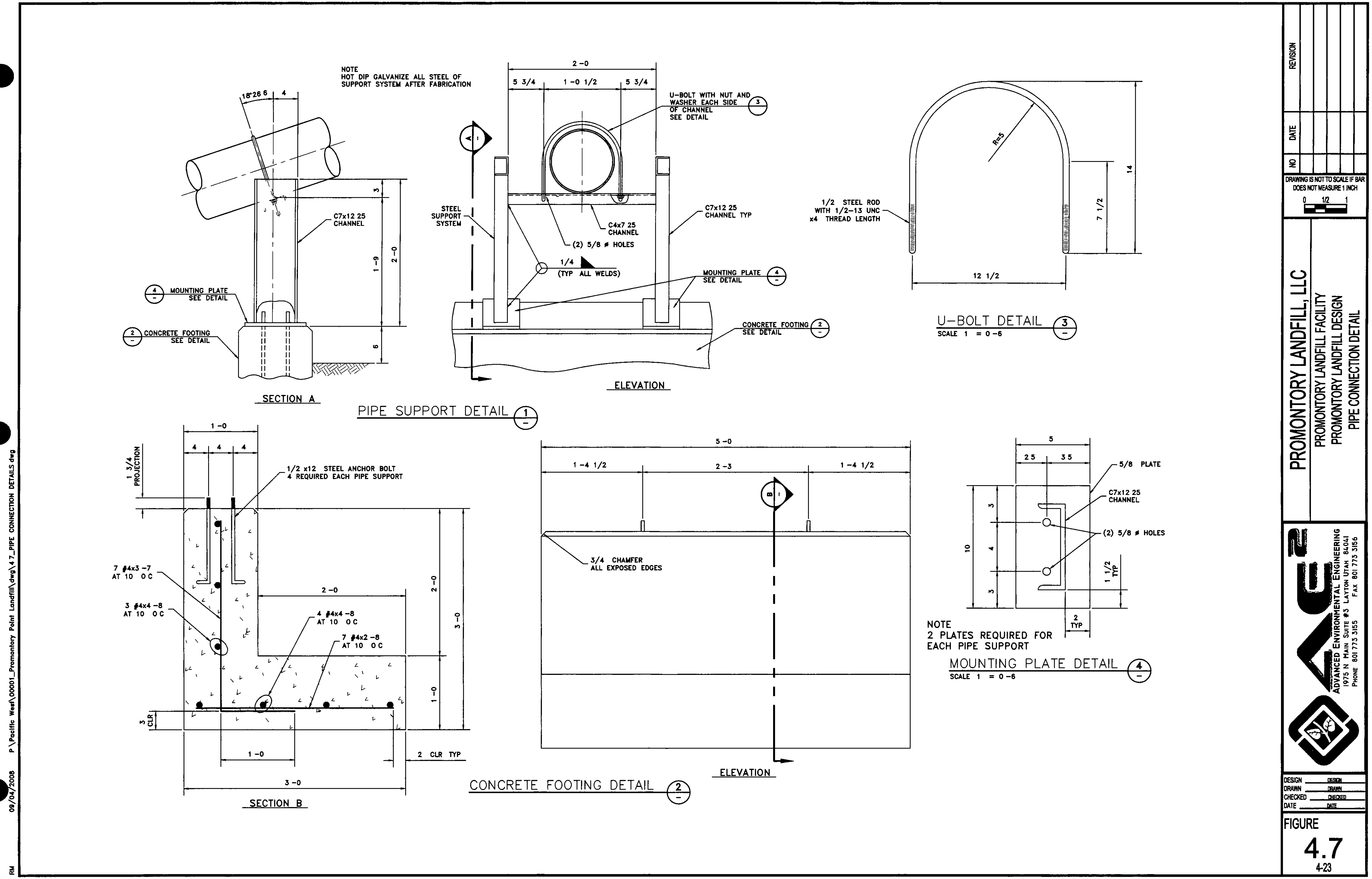
PROMONTORY LANDFILL FACILITY
PROMONTORY LANDFILL DESIGN
EVAPORATION BASIN DETAIL

ADVANCED ENVIRONMENTAL ENGINEERING
1975 N MAIN SUITE #3 LAYTON UTAH 84041
PHONE 801 773 3155 FAX 801 773 3156

DESIGN DESIGN
DRAWN DRAWN
CHECKED CHECKED
DATE DATE

FIGURE
4.6

DRAWING SOURCE AQUA ENGINEERING INC



DRAWING SOURCE AQUA ENGINEERING INC

4 7 RUN-ON AND RUN-OFF CONTROLS

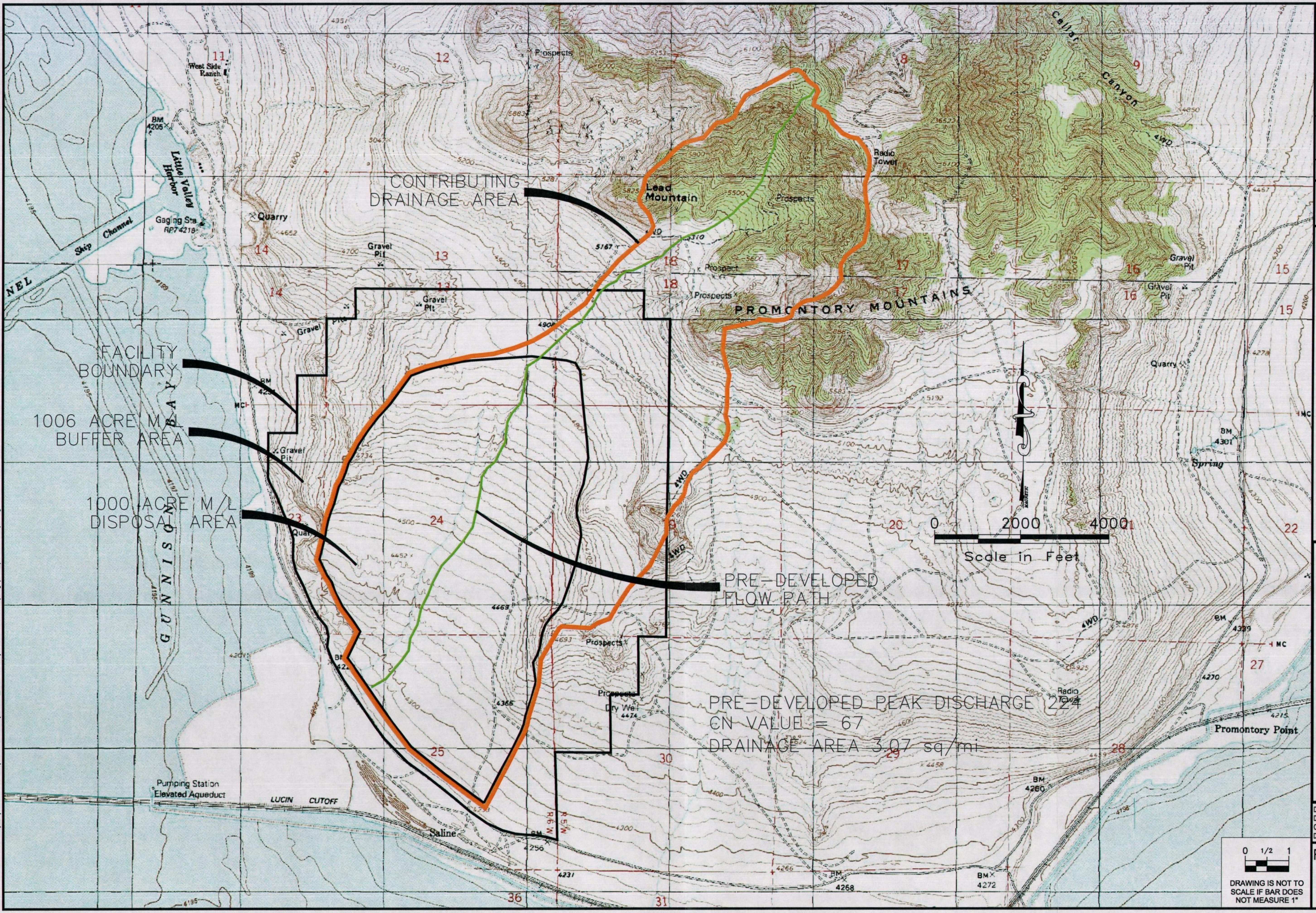
Run-on and run-off storm water would be controlled during both the open and closed phases of the disposal cells Drainage swales would be used to divert water around the modules to the existing on-site washes Final cover run-off would be routed to the perimeter drainage swales and discharged to the existing washes on the property in such a manner to minimize erosion Run-off along the access roads would be controlled with lowered profile waterways If required, culverts would be strategically placed along the access road

4 7 1 Run-on/Run-off Analysis

All storm water that comes in contact with waste must remain within the boundaries of the landfill liner system and be managed as leachate All storm water that does not come in contact with waste is not considered leachate and would not be allowed to enter the landfill Leachate collection system piping would be used to collect any run-on to the cell from the drainage swales to the lined cell

For permitting purposes, a drainage analysis was completed for the entire 1000-acre landfill cell All areas within the proposed facility that do not contribute run-on to the landfill cell were excluded The area contributing run-on flow to the 1000-acre landfill site is shown on Figure 4 8 and Figure 4 9 The entire drainage area was evaluated in both pre-developed and developed conditions Figure 4 8 shows the pre-developed site drainage and Figure 4 9 shows the developed site drainage

The quantity of flow expected for pre-developed and developed conditions was determined by using precipitation for the 25-year, 24-hour storm event of 2 2 inches (NOAA Atlas 2 published in 1973) The Runoff Curve Number of 67 was obtained based on soil hydrologic group "B" (sandy loam) and poor conditioned sagebrush with grass (BOR, 1977) The peak flow generated was determined by applying the U S Soil Conservation Service Technical Release Number 55 (SCS TR-55) method



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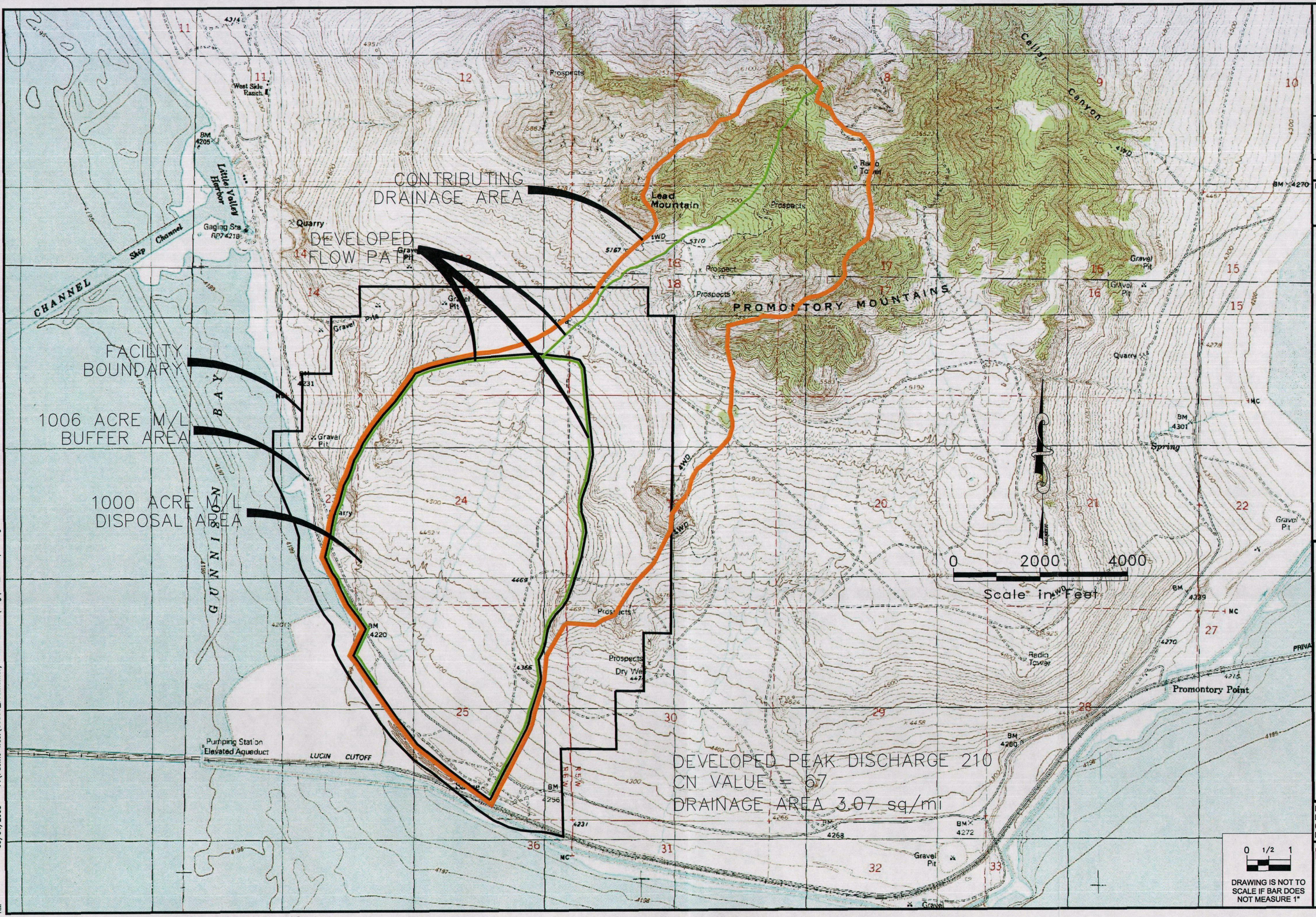
PROMONTORY LANDFILL, LLC
PROMONTORY LANDFILL FACILITY
PROMONTORY LANDFILL DESIGN
PRE-DEVELOPED SITE DRAINAGE

ADVANCED ENVIRONMENTAL ENGINEERING
1975 N. MAIN, SUITE #3, LAYTON UTAH 84041
PHONE: 801.773.3155 FAX: 801.773.3156

DESIGN: DESIGN
DRAWN: DRAWN
CHECKED: CHECKED
DATE: DATE

FIGURE:
4.8
4-25

DRAWING SOURCE: AQUA ENGINEERING, INC.



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DRAWING SOURCE: AQUA ENGINEERING, INC.

NO.	DATE	REVISION

DRAWING IS NOT TO SCALE IF BAR DOES NOT MEASURE 1 INCH

0 1/2 1

PROMONTORY LANDFILL, LLC

PROMONTORY LANDFILL FACILITY

PROMONTORY LANDFILL DESIGN

DEVELOPED SITE DRAINAGE

ADVANCED ENVIRONMENTAL ENGINEERING
975 N. MAIN, SUITE #3, LAYTON UTAH 84041
PHONE: 801.773.3155 FAX: 801.773.3156

DESIGN: DESIGN
DRAWN: DRAWN
CHECKED: CHECKED
DATE: DATE

0 1/2 1

DRAWING IS NOT TO SCALE IF BAR DOES NOT MEASURE 1"

FIGURE:
4.9
4-26

Details of the input parameters and the model output are included in Appendix J Table 4 8 shows the peak discharge generated from both pre-developed and developed conditions

TABLE 4 8

STORMWATER PEAK DISCHARGE

Condition	Peak Discharge (cfs)
Pre-developed	224
Developed	210

As the cells are developed, the site drainage paths are lengthened reducing the peak discharge rate from its original condition

4 7 2 Drainage Swales

If needed all future manmade swales would be constructed to include drop structures to maintain a channel velocity less than 2 5 to 3 5 (fps) These swales would be used to divert water around and away from the cell to reduce erosion potential

4 7 3 Culverts

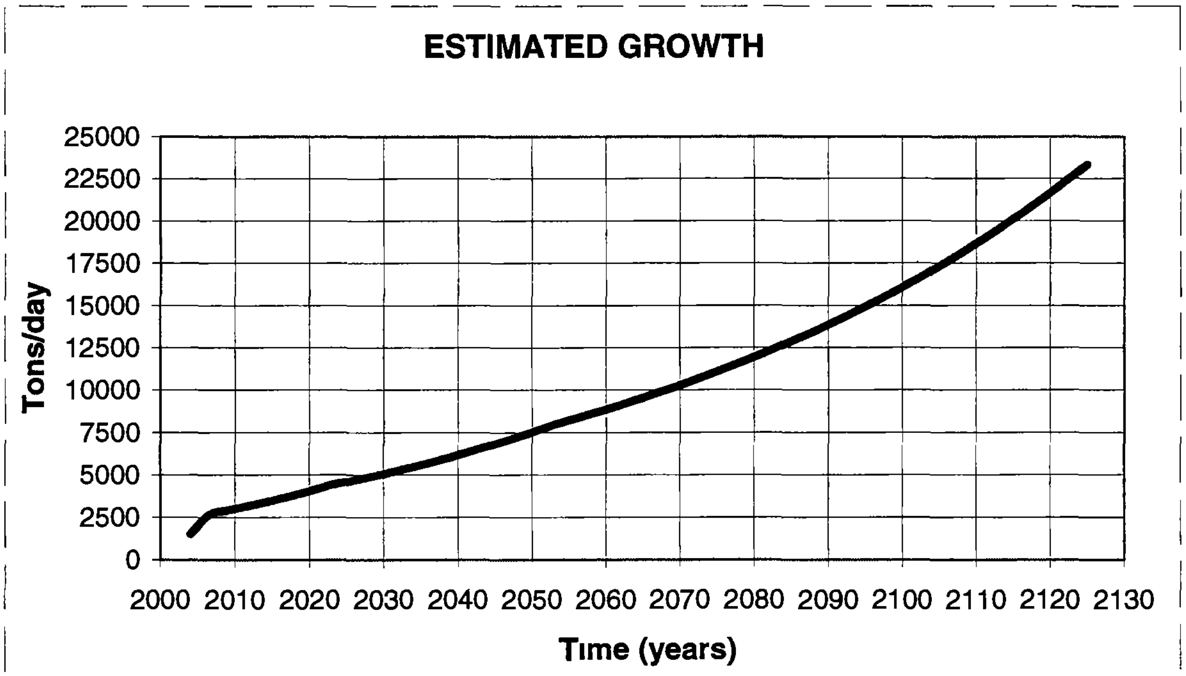
No culverts were identified during site investigations

4 8 LIFE EXPECTANCY

Every effort has been made to utilize assumptions and parameters in calculating the life expectancy of the landfill that are conservative The assumptions and parameters used are listed below Based on these, the Class I Landfill would be designed to meet the solid waste management requirements for a period of one hundred twenty-one years The spreadsheet used for this determination is located in Appendix K A graph of the expected growth pattern of the landfill is shown below in Figure 4 10 The following assumptions were used in the analysis

- A total of 1000 usable acres for Class I disposal
- The unit weight of the municipal solid wastes is 1200 lb/yd3
- 1500 tons per day for the first year of operation
- 2000 tons per day for the second year of operation
- 2500 tons per day for the third year of operation
- 2750 tons per day for the fourth year of operation
- 3% annual growth rate after the fourth year of operation
- 2% annual growth rate after the twentieth year of operation
- 1 5% annual growth rate after the fiftieth year of operation
- A 10% reduction of volume to account for intermediate cover

FIGURE 4 10



4 9 PERIMETER FENCING

Perimeter fencing would be provided for both security and retention of wind blown waste The perimeter fencing would enclose the facility's operational areas and is discussed further in Appendix L

4 10 WIND EROSION

The Promontory Landfill site is located on a peninsula in the Great Salt Lake Thus, the site is subject to changing prevailing winds, but the predominant winds are from the southwest Wind erosion at this location would primarily come from dust from earthwork operations, traffic and fugitive waste Each of these issues has been addressed to minimize man made causes of wind erosion

Blowing dust and dirt would be minimized by prevention and response to areas where the problem occurs Dust would be mitigated on an as needed basis using dust suppressants and road surface treatments Leachate may only be used as a suppressant on areas of the landfill that are overlain by an approved liner Stockpiles of dirt would also need to be monitored Disturbances of natural vegetation at the site would be minimized the extent possible in non-operational areas

Fugitive waste would be controlled by keeping incoming loads covered, an indoor transfer facility, use of temporary and permanent fencing in critical areas to retain waste, covered loads traveling to the tipping face, and periodic cleanup of fugitive waste around the site All shipments of waste into the facility would be covered Perimeter fencing would be designed to help contain fugitive waste on site Temporary fencing would be placed in locations of concern such as the working face Clean up of waste spills and captured waste would reduce the potential for off-site fugitive waste The site and surrounding area would be inspected regularly to determine effectiveness of the litter fencing and clean up scheduling A fugitive waste plan is included in Appendix L

CHAPTER V
PLAN OF OPERATION

5 1 PURPOSE

The purpose of the Plan of Operation (OP) is to provide a written description of the daily operation of the proposed Class I Landfill The proposed action will incorporate a Class I Landfill at the proposed Promontory Landfill Facility

A landfill is a dynamic system that undergoes continual development Changes may occur in quantities of disposed materials, topography of the landfill, demographics of the service area, and administrative or regulatory requirements These changes would be accomplished to conserve landfill space and protect human health and the environment The intent of this OP is to provide an accurate description of the daily operations and procedures while allowing for modifications, which may be required to compensate for operational changes

5 2 SCHEDULE OF CONSTRUCTION

Construction of the landfill facilities will not begin until a waste stream of sufficient size and duration is procured to assure a successful venture A waste stream of at least 25,000 tons annually is required prior to construction of facilities Procurement of this waste stream is dependent upon issuance of Request for Proposals from agencies of government

Assuming a suitable waste stream is procured, construction of facilities will commence within 18 months of issuance of the permit A preliminary construction schedule has been included below

Box Elder County Site Plan Approval – Site Plan Design, Site Plan Negotiations, Planning Commission Approval, and County Commission Approval
Estimated duration of 120 days

Procurement of Waste Stream – Finalize Negotiations and Execution of Contracts

Estimated duration of 210 days

Landfill Construction – Engineering/Construction Drawings, Approval for Union Pacific Truck Layout, Procurement of Building Permits, Procurement of a Septic System Permit, Field Survey/Layout, Utility Installation, Clear and Grub, and Construction of Rail Spur, Out Buildings, and Waste Disposal Module

Estimated Duration of 210 days

5 2 1 Excavation and Construction of the Cells

Excavation of the cells would begin with grubbing and removal of shrubs, grass, and other vegetation The surface soil is stripped to a minimum depth of 6 inches and stockpiled The cell would be excavated to the maximum extent possible maintaining a minimum slope of 5% and maintaining at least one foot of site soils over any exposed bedrock The surface would not contain stones or other matter of such composition, shape, or size which may be damaging to the liner system

All loads incoming by truck will be weighed on platform scales prior to traveling to the tipping face Containers arriving by railwill either be weighed or rail scales or transferred to trucks and weighed on the platform truck scales

All refuse would be trucked to the tipping face and dumped Waste utilized as select waste will be deposited on adjacent existing layers of waste It will be spread with a dozer and all unacceptable material sorted and removed It will then be dozed in a three foot lift onto the hner system and compacted with a landfill compactor in multiple passes

Municipal solid waste not designated as select will be dumped at the tipping face and then spread and compacted using a combination of track type bulldozer and landfill compactors Waste will be placed and compacted in a manor to optimize both production and compaction

Operations at the tipping face will not take place without temporary 12'-high fencing to control fugitive waste. Said fence shall move with the operation being placed within 200 feet or less from the tipping face Tipping operations will be limited to one area at a time to control the amount of exposed waste The size of the working face will be minimized and anticipated to be less than one-half acre

Daily and intermediate cover will be generated from borrow areas within the buffer zone or from processing operations in Little Valley A minimum of 1000 cubic yards of cover material will be available in stockpile or accessible from borrow areas at all times This adequately covers the anticipated maximum size working face by a factor of two which leaves plenty of material available for contingencies The cover material will be loaded, transported, and deposited on the refuse with rubber-tired wheel scrapers, fine graded with bulldozers (as needed), and compacted with the landfill compactor (or a soil compactor at the direction of the Landfill Operator) If an area is not to be actively landfill more that 30 days, intermediate cover will be applied Intermediate cover shall have a minimum thickness of 12 inches

The final cover for the Class I cell would be designed using Bentomat (ST), 40 mil VFPE, bi-planar drainage net and 18 inches of site soils The cover would then be seeded and lightly compacted to support vegetation and reduce erosion

5 2 2 Equipment

The Owner would maintain the necessary equipment to off-load, spread and compact waste, control dust, and perform other facility operations The following Table 5 1 is a preliminary list of the possible equipment that may be used on the site

Table 5 1
PROMONTORY LANDFILL EQUIPMENT LIST

Equipment Description	No of Pieces	Purpose
Front-end Loader	1	Handle MSW at unloading facility
Articulatated off-road truck, Cat D400E size	2	Haul solid waste from rail siding to cells
Self-loading scraper, Cat 623 size	2	Excavate for cells, haul covered material
Track mounted dozer Cat D8 size	1	Place solid waste in cells
Track mounted dozer Cat D9 size	1	Cell and cover material excavation
Landfill compactor, Cat 836G size	1-2	Compact solid waste
Motorgrader, Cat 140G size	1	Construct/maintain haul roads and cells
Front-end loader Cat 966IT size	1	Handle bail garbage, road/berm construction
Truck mounted 4000 gallon water tand	1	Dust control
Tractor mounted 10,000 gallon water wagon	1	Dust control
Super sucker vacuum truck	1	Clean rail cars
Steam boiler	1	Heat water to clean railcars
Railroad locomotive	1	Move railcars

5 3 ON-SITE SOLID WASTE HANDLING PROCEDURES

Daily operation of the Class I Landfill and related facilities would be under the direction of the Landfill Manager In the event of the Landfill Manager's absence, a Senior Operator would be the designee in charge of the landfill

A landfill entrance sign will be constructed and will provide the landfill name, hours of operation, list of materials not accepted by the landfill, and emergency contact information

At the beginning of each working day, the Landfill Manager would be responsible for informing operators of any special off-loading conditions, for either trucks or the railroad, and where to direct solid waste for disposal The Landfill Manager or Senior Operator would be responsible for directing each transport vehicle to the proper location for disposal of its waste This could alternatively be accomplished through the placement of directional signs The Landfill Manager or the Senior Operator would be at the landfill during all operating hours

The Owner probably would elect to construct scales for the Class I Landfill The scale operator would perform load counts on a daily basis and make a record of the load source

Incoming refuse directed toward the landfill would be deposited at the working face under direction the Landfill Manager or Senior Operator

5 4 MONITORING SCHEDULE

A Monitoring Plan has been developed to help in the prevention of problems that may preventable through careful monitoring and inspection The schedule provides details on groundwater monitoring, leachate monitoring, and landfill gas monitoring A copy of the Monitoring Plan is included in Appendix M

5 5 EMERGENCY OPERATIONS PLAN

The Emergency Operations Plan for the proposed facility is included in Appendix N The Emergency Operations Plan provides protocols for landfill employees in cases of emergency Should an emergency happen, the DEQ may elect to waive daily cover requirements on C & D Materials

5 6 CONTINGENCY PLAN

The Contingency Plan is designed to minimize hazards to human health or the environment from any unplanned sudden or non-sudden discharge to air, soil, surface, or groundwater The provisions of this plan would be carried out immediately upon an emergency situation or release, which could threaten human health or the environment Emergency evacuation of the site could be necessary given the nature of the waste materials stored and processed at the site Incidents at the landfill could be caused by fire, explosion, or toxic vapor generation

5 6 1 Fire or Explosion

A fire suppression area shall be designated as the location for any burning materials to be moved or to be consolidated on for fire suppression activities This areas shall not be located within 150 feet of any exposed HDPE liner or within 5 vertical feed of any existing liner This area may move from time to time to be in close proximity to the working area of the landfill operations

Vehicle Fires In the event that a disposal vehicle carrying a burning or smoldering load of waste enters the landfill site

1 The vehicle should be directed to the designated fire suppression area as previously outlined above
2 Once burning waste is removed from the vehicle, the application of cover material by landfill equipment or the application of water by the on-site water truck will be used to extinguish the fire Suffocation with cover material will be the primary method used to extinguish fire
3 Vehicles and any equipment in the "fire zone" will be inspected and sprayed with water while working to quench the fire
4 Precautions should be taken throughout the entire fire-fighting operation including using a hot-spot observer
5 If, at any time, additional assistance is required, local fire-fighting units will be contacted

Ground Fire/Below Cover Fire In the even that waste placed on the ground or waste that was previously covered erupts into fire

1 It will be isolated from previously deposited waste immediately This will be done by either moving burning waste to the designated fire suppression area or by concentrating the burning waste in one spot using landfill equipment

2 Once burning waste is separated from other exposed waste, the fire will be extinguished by the application of cover material by landfill earth moving equipment or the application of water by the on-site water truck Suffocation using cover material will be the primary method used to extinguish fire

3 Vehicles and any equipment in the "fire zone" would be inspected and sprayed with water while working to quell the fire

4 Precautions should be taken throughout the fire-fighting operation, including using a hot-spot observer

5 If, at any time, additional assistance is required, local fire-fightmg units will be contacted

<u>Explosion</u> In the event that an explosion should occur at the landfill or in any structure associated with the landfill site

1 All personnel and equipment in the area, including those in surrounding buildings will be evacuated immediately

2 All landfill personnel will be accounted for

3 Local emergency personnel will be contacted

4 The Landfill Supervisor will be informed of the situation if he/she is not already at the site

5 The explosion area will be restricted to all personnel until cleared for reentry by local emergency personnel

6 Precautions should be taken throughout the entire emergency response operations

7 The President of Promontory Landfill, LLC or his/her designee will be the only person authorized to make statements to the media

5 6 2 Explosive Gas Release

Methane gas release would be detected using a methane detection meter capable of measuring methane levels below the 25% Lower Explosion Limit Gas monitoring would be conducted around the disposal area and in any of the facility structures Upon detection of explosive gases equal to or above the lower explosion limit, the Owner or Operator would take the following steps

1 Immediately upon detection, steps would be taken to protect human health These steps would include accounting for all landfill personnel and moving all equipment and personnel away from the release area, shutdown of any electrical devices that could cause ignition, notify emergency personnel (fire, police) and advise them of the situation, monitor the release area and surrounding areas with a combustible gas indicator and document reading for placement into the operating record, determination of the cause of explosive gas, and keep the area closed until corrective actions are taken
2 Within 24 hours the Executive Secretary would be notified
3 Within seven days of detection, the explosive gas levels would be recorded in the operating record along with a description of the steps taken to protect human health
4 Within 60 days of detection, a remediation plan that had been approved by the Executive Secretary would be implemented and a copy of the plan placed in the operating record Upon implementation, the Executive Secretary would be notified

5 6 3 Failure of Drainage Containment System

If the containment system were to fail, the following actions would be taken

1 Construct berms and ditches to divert water around the containment failure area using site soils or readily available materials

2 Analyze and evaluate the extent of damage to the containment system

3 Identify the mechanism of failure

4 If warranted call a qualified professional to discuss possible solutions

5 Develop and implement corrective actions

5 6 4 Temporary Equipment Breakdown / Extreme Weather Events

The Operator owns numerous pieces of equipment that could be promptly mobilized if warranted If this equipment were not available, rental equipment is readily accessible along the Wasatch Front Should an extreme weather event occur, waste entering the facility would be temporarily stored in the transfer building Haulers would be notified to temporarily stop shipping waste Waste would then be briefly stored at the Transfer Stations until the event passed Transfer Stations are designed for adequate storage for temporary extreme events like this

5 7 ALTERNATIVE WASTE HANDLING AND DISPOSAL PLAN

In the event of a major equipment failure, solid waste would be loaded and shipped to an alternative waste disposal facility such as Box Elder County, Elko County, or other available landfills in the area A contract will be negotiated for an alternative disposal location prior to the facility operating

5 8 PROCEDURES FOR CONTROLLING DISEASE VECTORS

The use of daily cover and the exclusion of specific types of solid waste are necessary to control vectors and the subsequent spread of disease Special waste such as infectious waste, liquid waste and tires, which may directly carry disease or lead to the propagation of disease vectors, would be immediately covered at the working face Landfill personnel to the extent possible would inspect the site for signs and indications of disease vectors If observations were made the Landfill Manager would be contacted immediately If disease vectors were to become a problem, pest control specialists would be contacted to reduce the spread of disease

5 9 PROCEDURES FOR EXCLUDING THE RECEIPT OF HAZARDOUS WASTE

A "Prohibited Waste" control program designed to detect and deter attempts to dispose of hazardous and other unacceptable waste would be implemented at the proposed Promontory Landfill Facility The program is designed to protect the health and safety of employees, customers, and the general public, as well as protect against contamination of the environment The Landfill Manager would be in charge of hazardous waste activities

The waste disposed at the proposed landfill would be visually inspected prior to final placement The waste would be inspected at off-site transfer stations and on-site Further information about each of these inspection locations are listed below

- The proposed landfill only accepts waste from any transfer stations that have a waste inspection plan approved by the Executive Secretary Operators at the transfer stations would visually inspect waste for hazardous materials before loading for transit

- On-site inspection would be conducted at the working face Landfill operators will be trained in the recognition of prohibited waste A random testing program would be conducted of all waste that has not already been inspected at transfer stations These inspections would be conducted on one percent of all loads not obtained from transfer stations with a waste inspection plan approved by the Executive Secretary A sample form for these inspections has been included in Appendix O All waste would be visually inspected as it is being placed, spread and compacted in the cell and upon finding any unacceptable waste the following steps would be taken

1 Using landfill equipment such as an excavator or a loader, separate the questionable waste from the other waste m the load Move the questionable waste away from the operating area of the tipping floor or tipping face so that operations can continue
2 Notify the Landfill Supervisor immediately of the problem and the Generator of the waste and wait for direction
3 Keep all other landfill personnel and equipment away from the questionable wastes until notified by the Landfill Supervisor or his/her designee to do otherwise
4 The Landfill Supervisor shall notify the generator of the problem and allow the Generator 24 hours to remove the material from the premises
5 If the Generator does not respond in a timely fashion, remove the waste from the Landfill and dispose of it in a facility appropriate for the type of waste Note the details of all actions in the Operating Record

5 10 GENERAL TRAINING AND SAFETY PLAN

Each employee at the landfill facility would be trained to have a working knowledge of the maintenance and operational techniques necessary to operate and maintain the landfill facility in a manner to preserve human health, safety, and the environment Training would be accomplished through on-the-job training (OJT) and classroom training sessions The Landfill Manager, or a designated professional trainer, would be in charge of directing the training programs Initial training would be completed within three months of employment followed by an annual review of basic waste management skills

5 10 1 Training Schedule

The Landfill Manager would be required to pass the SWANA Manager of Landfill Operations (MOLO) course or equivalent In addition, operators are required to take one or both of the SWANA training courses Landfill Operator Training, and Waste Screening or equivalent Continuing education efforts include the following

Introductory Training

Synopsis of solid waste regulations, record keeping, and transporter requirements

- Requirement All Personnel
- Method OJT
- Review Quarterly

Policies and Procedures

Security, inspections and emergency response

- Requirement All Personnel
- Method Lecture/Video Course, OJT
- Review Quarterly

Safety

Personal protection, hazardous waste recognition, hazardous material handling, emergency response, and first aid

- Requirement All Personnel
- Method Classroom/Video Course
- Review Annual

A Safety Training meeting is held once a week taking a minimum of 15 minutes Training documents would be kept with the Plan of Operation for a rolling five year period

5 11 RECORD KEEPING AND REPORTING

The Landfill Manager would maintain the following operating records for the landfill

- Records of maintenance
- Records of training and notification procedures
- Records of groundwater monitoring
- Records of landfill gas monitoring
- Records of weights and volume, number of trucks and railcars
- Deviations from the plan of operation
- Records of placement or recirculation of leachate
- Records of any gas condensate
- Prepare an annual report and place the report in the facility's operating record

Sample forms for maintenance and gas monitoring are provided in Appendix O

CHAPTER VI
CLOSURE AND POST-CLOSURE PLANS

6 1 PURPOSE

Closure activities would be implemented as each module within the disposal cell is completed These closure activities would minimize the need for further maintenance, and minimize or eliminate the threat to human health and the environment from post-closure escape of solid waste constituents, leachate, contaminated run-off or waste decomposition products to the ground, ground water, surface water or the atmosphere A Monitoring Plan has been developed to prevent problems through careful monitoring and inspection The plan provides details on groundwater monitoring leachate monitoring, and landfill gas and is included in Appendix M

6 2 FINAL COVER AND GRADING

The final cover would commence no later than 30 days after the final volume of waste was received in each module and would be completed within 180 days after the beginning of the closure activities The proposed final cover would consist of the following layers (or equal), Bentomat (ST), 40 mil textured VFPE, Fabricap Geocomposite with 6 oz Geotextile bonded to both sides, and eighteen inches of site soils

6 2 1 Revegetation

Revegetating the cover would consist of using an appropriate seed mix The cover would be prepared to a clean, firm, and consistent seedbed The seeds would be drilled ½ to ¼ inch deep or broadcasted in areas where drilling was found to be impractical

6 3 FINAL INSPECTION

The Owner or Operator would notify the Executive Secretary of the Solid and Hazardous Waste Control Board (hereafter called Executive Secretary) of the intent to implement the closure plan 60 days prior to the projected final receipt of waste The Owner or Operator would commence implementation of the closure plan within 30 days of final volume of waste and the cover would be completed within 180 days The Owner or Operator then would have 90 days to submit the following items to the Executive Secretary Closure plan sheets signed by a professional engineer registered in the State of Utah and a certificate from the engineer The certificate would require a final inspection performed by the engineer to verify that the landfill was in compliance with all closure requirements as outlined in the permit and closure plans Inspection would include cell cover design, run-on and run-off control, proper final grading to promote run-off, and restriction of access to the site by fencing No later than 60 days after certification of closure, submit plats and a statement of fact concerning the location of any disposal site would be given to the county recorder to be recorded as part of the record of title Proof of record of title then would be submitted to the Executive Secretary

6 4 OPINION OF PROBABLE COSTS FOR CLOSURE

The opinion of probable costs for the final closure of the Class I Landfill has been prepared to comply with the Financial Assurance requirements and is presented in Table 6 1 The unit costs values were developed for a 20-acre parcel, using third party construction costs The Owner may elect to stockpile cover materials in exchange for closure funds and would inventory stockpiled materials for each annual report

TABLE 6 1
OPINION OF PROBABLE COSTS FOR CLOSURE

Task	Quantity	Units	Unit Cost	Task Cost
CLOSURE				
Mitigate, Fill, and Grade	20	Acre	$2,000	$40,000
Furnish and Install Benotmat ST	871,205	SF	$0 50	$435,603
Furnish and Install 40 mil VFPE	871,205	SF	$0 35	$304,922
Furnish and Install Fabricap Geocomposite	871,205	SF	$0 55	$479 163
Move & Place Site Soils (18")	48,400	CY	$5 00	$242 000
Final Grading	20	AC	$1,500	$30,000
Revegetation	20	AC	$1,300	$26,000
Survey & Engineer Certification	1	LS	$7,000	$7,000
Subtotal				**$ 1,564,688**
POST-CLOSURE				
Gas Monitoring	30	Yr	$500	$15,000
Groundwater Monitoring	30	Yr	$1,200	$360,000
Run-on/Run-off	30	Yr	$500	$15,000
Leachate Collection System	30	Yr	$500	$15,000
Cover Erosion/Revegetation/Fencing	30	Yr	$1,000	$30,000
Settlement	30	Yr	$500	$15,000
Subtotal				**$450,000**
Total				**$2,014,688**

6 5 POST-CLOSURE MAINTENANCE

Contact information for the Post-Closure Care Provider is listed below

Name	Mike Forrest, Solid Waste Director
Address	1515 West 2200 South, Suite #C

Salt Lake City, Utah 84119
Phone (801) 972-2727

Closure of the Class 1 Landfill would be as follows The disposal cell was designed to eliminate infiltration through the cover to prevent the generation of leachate This was accomplished by promoting drainage and evapotranspiration from the cover, and by preventing percolation of precipitation into the disposal cell The proposed final cover would consist of the following layers (or equal), Bentomat (ST), 60 mil textured VFPE, Fabricap Geocomposite with 6 oz Geotextile bonded to both sides, and eighteen inches of site soils

The waste surface would be prepared so as to be free of irregularities, protrusions, vegetation, excessive water, loose soil or abrupt changes in grade The surface would not contain stones or other matter of such composition, shape, or size, which may be damaging to the geomembrane as specified by the manufacturer The anchor trenches would be constructed to the lines, widths, and depths recommended by the manufacturer To avoid damage to the membranes, the edges where the geosynthetic enter the trench would be free of irregularities, protrusions, etc Backfill operations would be conducted when the geosynthetic matter is at its most contracted state to prevent bridging The fill material would be placed in a manor to prevent damaging the membrane The fill material would be compacted to 85% max dry density per ASHTO T-99 Drainage channels would be constructed around the cell as indicated by the drawings to help prevent erosion and divert any run-on and run-off in a controlled manor Berms would be placed and used as needed

Post-closure care would be conducted in accordance with this Post-Closure Plan The schedule for post-closure activities would begin on the date of completion of closure of the disposal cell and continue for 30 years, or until the Executive Secretary determined that the disposal unit had become stabilized and human health and the environment were sufficiently protected The Owner would initiate post-closure activities within six months following completion of closure Table 6 2 lists a monitoring and inspection schedule for post-closure care

TABLE 6 2
POST-CLOSURE MONITORING AND INSPECTION SCHEDULE

Task	Schedule
Landfill Gas	Quarterly
Groundwater	Semiannually
Run-on/Run-off	Quarterly
Leachate Collection System	Quarterly
Cover Erosion	Quarterly
Settlement	Quarterly
Fencing	Quarterly
Vegetation	Quarterly

In the event that significant settlement occurred within the closed landfill, the area would be surveyed and additional soil would be obtained from the site and placed in a manner to preserve the design finish grade Any such soil placed on the unit would be re-vegetated Post-closure activities would be financed as outlined in the Financial Assurance Plan Post-closure care and monitoring would be completed, as determined by the Executive Secretary, when either the 30 year post-closure period was complete, or the unit had stabilized Upon completion of post-closure care, a post-closure period certificate would be submitted to the Executive Secretary signed by the Owner or Operator

CHAPTER VII
FINANCIAL ASSURANCE PLAN

7 1 FINANCIAL RESPONSIBILITIES

The Owner has selected to obtain a surety bond guaranteeing performance to meet the criteria set forth in R315-309-3(4) The owner or operator would notify the Executive Secretary that a copy of the bond has been placed in the operating record As tipping fees are collected, funds will be deposited into a Trust Fund for closure and post-closure care As the amount in the Trust Fund grows, the performance bond will be devalued accordingly until such time as there are sufficient cash reserves to retire the bond

CHAPTER VIII

REFERENCES

Advanced Environmental Engineering, September 2007, *Class I & IVa Landfill Permit Application*, The Duchesne/Wasatch Bluebench Landfill Special Service District

AQUA Engineering, August 2003, *Class I Permit Application*, Promontory Point Landfill LLC

AQUA Engineering, Revised June 2000, *Amendment to the Class IIIb Landfill Permit Application*, Tooele County Department of Solid Waste

AQUA Engineering, October 1999, *Class II Landfill Permit Application*, Tooele County Department of Solid Waste

Fredlund, D G and Rahardjo, h , 1993, *Soil Mechanics for Unsaturated Soils*, Annotation copyright Books News, Inc Portland, Oregon

Kleinfelder, December 1997, *Permit Application*, Salt Lake Valley Solid Waste Management Facility

NOAA, 1973, NOAA Atlas 2

United States Geological Survey, 1991, Promontory Point, Utah 7 5 Minute Topographic Quadrangle

Wood, J W , 1972, *Hydrologic Reconnaissance of the Promontory Mountains Area Box Elder County, Utah, 1972, Technical Publication No 38*, State of Utah Department of Natural Resources

APPENDIX A
CONTRACTS/AGREEMENTS

PACIFIC WEST

1515 West 2200 South Suite C Salt Lake City Utah 84119
Office Telephone (801) 972 2727 / FAX (801) 972 0707

August 22 2008

Mr Dennis R Downs Executive Secretary
Utah Department of Environmental Quality
Division of Solid and Hazardous Waste
P O Box 14480
Salt Lake City UT 84114-4880

Subject Promontory Landfill, Authorization to Sign

Dear Mr Downs

Michael J Forrest is now the authorized representative for Promontory Landfill LLC the Owner of the landfill and Pacific West LLC as the operator of the landfill Michael has the authority to sign for Promontory Landfill LLC as its official agent and representative

Mark H Easton will no longer act as the authorized representative effective immediately

If you have any questions please do not hesitate to contact us

Sincerely yours,

Pacific West, LLC

Jay Harwood

Jay Harwood
Managing Member – Pacific West, LLC
Managing Member – Promontory Landfill LLC

Notarized this 22nd day of August 2008

Amy B Norton
Signature

Notary Public
AMY B NORTON
11? ? A sa Meadow Drive
Sou? Jordan UT 84095
My Commission Expires
October 6 2009
State of Utah

TOOELE COUNTY CORPORATION
CONTRACT # 03 06-05

AGREEMENT FOR SOLID WASTE DISPOSAL

THIS AGREEMENT is made and entered into as of this 17th day of June, 2003, by and between Tooele County, Utah, a body corporate and politic, located at 47 South Main Street, Tooele, Utah 84074 (hereinafter "County") and Promontory Landfill, LLC, a Utah Limited Liability Company, located at 1515 West 2200 South, Suite C, Salt Lake City, Utah 84119 (hereinafter "Owner")

WHEREAS, Owner is attempting to construct a Class I Landfill on Promontory Point in Box Elder County, Utah that will only accept municipal waste, and

WHEREAS, Owner has applied for a Class I Solid Waste Permit in the name of Promontory Landfill ("Promontory") from the State of Utah, Department of Environmental Quality, Division of Solid and Hazardous Waste, and

WHEREAS, County needs a low cost, long-term solution for its municipal waste that is environmentally sound and in compliance with all solid waste regulations, and

WHEREAS, the Utah Solid Waste Management Act, Section 26-32-1, et Seq , Utah Code Annotated 1953, as amended (the "Act"), provides that the governing body of a public entity may assume, by agreement, responsibility for the collection and disposition of solid waste whether generated within or outside of it's jurisdictional boundaries and that the said governing body may enter into long-term agreements with private entities to provide for the operation of a solid waste management facility, and

WHEREAS, the County and Owner are desirous of contracting with each other to provide for the disposal and management of solid waste generated by households, governmental offices and retail establishments within the County ("the County's Solid Waste")

NOW THEREFORE, for good and valuable consideration, the receipt and sufficiency of which is hereby acknowledged, the County and Owner agree as follows

1 *Disposal Site for County's Solid Waste* Conditional upon receipt of all licenses and permits required by local, state, and federal law for operation of a Class I Landfill and conditional upon physical construction and opening of Promontory, Owner agrees to provide space within Promontory for the disposal of the County's Solid Waste, provided however, that the County's Solid Waste must be lawfully transported to Promontory by commercial carriers only at the County's sole expense County and Owner further agree that Promontory shall not be open or otherwise be made

available for access by the general public and that access thereto for the deposit of the County's Solid Waste shall be restricted to those entities licensed by County and approved by Owner for the transport of the County's Solid Waste from the County to Promontory, provided such entities deliver or transport County's Solid Waste in a manner consistent with current practices for the transportation and delivery of the County's Solid Waste to existing landfills in the State of Utah

Owner hereby reserves the right to reject for disposal any and all of the County's Solid Waste which may be legally classified or identified as a material or substance other than Solid Waste as defined by the Act

2 *County Agrees to Ship Waste* Conditional upon Owner's receipt of all licenses and permits required by local, state, and federal law for operation of a Class I Landfill and conditional upon Owner's operation of Promontory in accordance with said licenses and permits, County agrees to ship all or a part of its Solid Waste to Promontory at a mutually agreed upon rate

3 *County Assistance* County agrees to provide assistance to Owner through the services of Dave Lore to complete the Class I Landfill permitting process with the Utah Department of Environmental Quality, Division of Solid and Hazardous Waste

4 *Owner Assistance to County* Owner agrees to assist County to acquiring the lowest best transportation rates for County's Solid Waste from commercial carriers

5 *Interlocal Agreement* County employee Dave Lore will assist Owner in forming an Interlocal Agreement with other counties and cities One function of the Interlocal Agreement will create an Interlocal Council to govern Promontory Owner agrees to give control of the landfill to an Interlocal Council, including the closure and post-closure funds as well as final ownership of the land Owner reserves the right to operate Promontory either directly or through its affiliate company, Pacific West LLC

6 *Term of Agreement* This Agreement shall be effective upon its execution by County and Owner, provided, however, Owner shall not be obligated to accept the County's Solid Waste for deposit or disposal in Promontory until Owner commences operations at Promontory This Agreement shall continue in full force and effect (i) so long as Promontory remains in operation under applicable permits issued by the State of Utah and Box Elder County, Utah or (ii) for ten (10) years following the first acceptance of the County's Solid Waste in Promontory or (iii) creation and full execution of an Interlocal Agreement which will supercede this Agreement, whichever of the three options occurs first The County will

have an option to renew this Contract for an additional period of (ten) years

7 *Assignment* This Agreement shall be assignable by Owner only upon the consent of County, provided that the County shall not unreasonably withhold such consent and provided further that the County's prior consent shall not be required for an assignment by Owner to any person or entity currently affiliated with Owner or any assignment by County to Owner

8 *Applicable Law, Venue* This Agreement shall be constructed and enforced in accordance with the provisions of the laws of the State of Utah Venue of any actions brought to enforce, construe, cancel, terminate, rescind or recover for the breach of the provisions of the Agreement shall be in the courts of Salt Lake County, Utah

9 *Entire Agreement* The County and Owner acknowledge and agree that this Agreement contains the entire agreement between them and supercedes all previous discussions and oral agreements between them relating in any way to the arrangements for the deposit and delivery of the County's Solid Waste in Promontory and may only be modified or amended by a written agreement executed by both the Owner and the County

10 *Agreement Binding* This Agreement shall be binding upon and inure to the benefit of the County's and Owner's successors and assigns

11 *Enforceability* The County and Owner represent and warrant to the other that this Agreement is the authorized action of each, that this Agreement is duly executed in conformity with the requirements of all applicable law and that this Agreement is enforceable in accordance with its terms

This Agreement was executed by Owner and presented to the Governing Body of Tooele County and was accepted and approved by that Governing Body on the [illegible] day of [illegible] 2003

Tooele County	Promontory Landfill, LLC
[signature] Act Chair	[signature]
Dennis Rockwell, Chairman Tooele County Commission	Jay Harwood, President

Attest

[signature]

Dennis Ewing, Clerk

COUNTY OF TOOELE
COUNTY CLERK
STATE OF UTAH

WEBER COUNTY

DEPARTMENT OF OPERATIONS/
PROPERTY MANAGEMENT
Gary C. Laird
Director

Richard C. Badger
Assistant Director

Danny D. Salazar
Property Management

Ron Ferro
Telecommunications

August 14, 2002

Kerry Zundell
Promontory Point Landfill
Clock Tower Building Suite # 302
550 North Main Street
Logan, UT 84321

Dear Kerry

This is in response to your letter of February 2002 and subsequent meetings with you and the County Commission As we have discussed on numerous occasions, the prospect for s Municipal Solid Waste Landfill at Promontory Point is exciting to Weber County We feel that competition in this industry cannot only be healthy for the landfill industry but for the ultimate beneficiaries, the tax payers of the county

As you are aware we have a contract with East Carbon Development Corporation and would continue to do business with them as long as we are under contract. However, since there is not a guaranteed waste stream under that contract, the county could send a portion of the waste stream to another location as long as it meets our general conditions. These conditions are as follows.

1. The alternate site is permitted by the State of Utah Department of Environmental Quality meeting all of their requirements including, all environmental issues, Historical site issues, Indian artifacts issues, and any groundwater issues, as they relate to the effect on the Great Salt Lake

2. All containers will be subject to a minimum three-day turn around.

3 The cost of all associated tipping fees, transportation, purchase of rail cars and containers, logistical setups, closure/ post closure fees are less than $16 00/per ton

4 A closure/post closure fund is to be escrowed and control of those funds be tied to the landfill and cannot be used in any bankruptcy settlement to pay any other outstanding debt except closure of the facility

5 An alternative truck route in the event of a problem with rail access must be verified. A plan to contract for that service must also be approved by the county

6 Operations price increases of the landfill must be controlled by the users of the facility who will form a management Board of Directors with each participating entity representing one vote

Department of Operations
444 - 24th Street
Ogden, Utah 84401
(801) 625-3850

7 The term of the agreement will be for 50 years with 5 year outs and an option to renew

If the PPLR can comply with these conditions, Weber County will commit up to 50% of its solid waste stream, which is approximately 75,000 tons per year

Our commitment is contingent upon all of the municipalities in Weber County continuing to use the County Transfer Station for solid waste disposal.

Sincerely,

Gary C Laird
Director

kal

APPENDIX B
CONDITIONAL USE PERMIT

BOX ELDER COUNTY

WE'VE GOT CONNECTIONS

Jay Harwood
Pacific West, LLC
1515 W 2200 S , Suite C
Salt Lake City, UT 84119

Dear Mr Harwood

This letter is sent to inform you that the Box Elder County Commission approved your request for an extension of your Conditional Use Permit, CUP 03-02, in a regularly scheduled meeting of the Box Elder County Commission held on August 14, 2007

If you have any further questions regarding this matter, please feel free to contact me My direct line is (435) 734-3313

Sincerely

Kevin D Hamilton, Director
Box Elder County Community Development

APPENDIX C
PROOF OF OWNERSHIP

PURCHASE AND SALE AGREEMENT

PURCHASE AND SALE AGREEMENT

THIS PURCHASE AND SALE AGREEMENT ("Agreement") is made and entered into as of the 13th day of June, 2003, by and between PROMONTORY POINT LAND RESOURCES LLC a Utah limited liability company ("Seller"), and PROMONTORY LANDFILL, LLC, a Utah limited liability company, its successors and assigns ("Buyer") Buyer and Seller shall sometimes be referred to herein as the "Parties" or, individually, as a "Party "

RECITALS

A Seller is the owner of approximately 2,000 acres of unimproved real property located on Promontory Point, Box Elder County, Utah (the "Property")

B Buyer intends to utilize the Property for a Landfill (as defined below)

C Seller desires to sell and Buyer desires to purchase the Property, subject to the terms and conditions of this Agreement

AGREEMENT

NOW, THEREFORE, in consideration of the above recitals, the mutual covenants set forth below in this Agreement, and other good and valuable consideration, the receipt and adequacy of which are hereby acknowledged, Seller and Buyer agree as follows

ARTICLE I

DEFINED TERMS

1 1 As used in this Agreement, the following capitalized terms shall have the meanings respectively indicated

(a) "Buyer's Review Period" means that period of time from the Effective Date until the earlier of (i) the date on which Buyer has obtained the State Permits and the County Permit, or (ii) December 15, 2007

(b) "Closing" means the transfer of title to the Property by Seller to Buyer in accordance with the terms and provisions of Article VII below

(c) "Closing Date" means the date specified in Article VII below on which the Closing will be held

(d) "County Permit" means the conditional use permit to be issued by Box Elder County authorizing Buyer or its assigns to utilize the Property to operate the Landfill

(e) "Department" means the Department of Environmental Quality, Division of Solid and Hazardous Waste, for the State of Utah

(f) "Earnest Money Deposit" means that portion of the Purchase Price deposited by Buyer with Seller in the form and amount specified in Section 3 1(a) below

(g) "Effective Date" means the date on which this Agreement has been executed by both Buyer and Seller

(h) "Landfill" means a Class I non-commercial nonhazardous waste landfill, as set forth in the Utah Administrative Code

(i) "Permitted Exceptions" means those exceptions or conditions that affect Seller's title to the Property, but which are acceptable to Buyer, pursuant to Section 4 6, below

(j) "Property" means the real property referenced in Recital A above and more particularly shown on Exhibit A attached to this Agreement including, all easements, agreements, permits, licenses, rights, rights-of-way, water rights, mineral rights and appurtenances running with or pertaining to the Property

(k) "State Permits" means the solid waste disposal and ground water discharge permits to be issued by the Department authorizing Buyer or its assigns to operate the Landfill on the Property

(l) "Title Company" shall mean Integrated Title Insurance Services, LLC, or another title company mutually acceptable to both Parties

ARTICLE II

AGREEMENT OF PURCHASE AND SALE

2 1 Purchase and Sale Upon the terms and conditions stated below, and in consideration of the mutual covenants set forth below, the receipt and sufficiency of which are hereby acknowledged, Seller hereby agrees to sell and convey the Property to Buyer and Buyer hereby agrees to purchase the Property from Seller and to pay the Purchase Price (as defined below) to Seller in accordance with the terms and provisions this Agreement

ARTICLE III

PURCHASE PRICE

3 1 Purchase Price The purchase price (the "Purchase Price") to be paid by Buyer to Seller for the Property is the sum of Two Hundred Fifty Thousand and No/100 Dollars ($250,000 00), payable as follows

(a) Earnest Money Deposit Five Thousand and No/100 Dollars ($5,000 00) in cash to be deposited by Buyer with Title Company (the "Earnest Money Deposit") and applied to the Purchase Price at the Closing The Earnest Money Deposit shall be held by the Title Company in a federally-insured, interest-bearing account to be applied or delivered as provided below Buyer shall be entitled to all interest accrued on the Earnest Money Deposit prior to the Closing

(b) The Closing Two Hundred Forty-Five Thousand and No/100 Dollars ($245,000 00) in cash to be deposited by Buyer with Title Company at the Closing and paid to Seller at the Closing

ARTICLE IV

CONDITIONS PRECEDENT

4 1 Commitment for Title Insurance Upon Buyer's request after the Effective Date, Seller shall obtain from the Title Company and furnish to Buyer a current Commitment for Title Insurance (the "Commitment"), issued by the Title Company, setting forth the state of title to the Property, together with all exceptions or conditions to such title, including without limitation, all liens, mortgages, trust deeds, easements, restrictions, rights-of-way, covenants, reservations, and all other encumbrances affecting the Property, and containing the express commitment of the Title Company to issue a Title Policy (as defined below) for the Property to Buyer in the amount of the Purchase Price, together with true, correct and legible copies of all instruments referred to in the Commitment as conditions or exceptions to title to the Property At the Closing, Seller shall convey to Buyer fee simple, marketable, and indefeasible title to the Property, free and clear of all liens, encumbrances, and other defects of title, except the Permitted Exceptions

4 2 Title Insurance At the Closing, Seller shall cause an ALTA Standard Coverage Owner's Policy of Title Insurance (a "Title Policy") for the Property to be furnished to Buyer The Title Policy shall be issued through the Title Company in the face amount of the Purchase Price, and shall insure fee simple, indefeasible, marketable title to the Property in Buyer, subject only to the Permitted Exceptions The cost of the Title Policy shall be paid by Seller

4 3 Survey Upon Buyer's request after the Effective Date, Seller shall deliver to Buyer all existing surveys and plat maps of the Property, or any portion thereof, which Seller has in its possession, if any All such surveys shall be referred to herein as the "Survey," whether one or more

4 4 Environmental and Other Studies Upon Buyer's request after the Effective Date, Seller shall deliver to Buyer all environmental studies and assessments, geotechnical and other studies of the Property, or any portion thereof, which Seller has in its possession if any Buyer shall have the right to obtain its own environmental assessments, structural and engineering assessments and other studies of the Property, at its own expense Buyer and its agents shall have the right to enter upon the Property for such purpose All such studies and assessments shall be referred to in this Agreement as the "Studies"

4 5 Governmental Documents Upon Buyer's request after the Effective Date, Seller shall deliver to Buyer copies of all information, agreements and documentation in Seller's possession relating to zoning, conditional use permits and any other governmental approvals or restrictions regarding the Property ("Governmental Documents")

4 6 Review of Materials by Buyer Buyer shall have access to the Property commencing on the Effective Date of this Agreement During Buyer s Review Period, Buyer shall review the Survey, the Commitment, and any documents referred to in either, and deliver in writing, by the end of Buyer's Review Period, such objections as Buyer may have to anything contained or set forth in the Survey, the Commitment, or any of the documents or conditions referred to in either Any such items to which Buyer does not object by the end of Buyer's Review Period shall be deemed to be "Permitted Exceptions" During Buyer's Review Period, Buyer shall also review the Studies and Governmental Documents If, within such period, Buyer determines that the Studies reveal facts, conditions or risks with respect to any of the Property that are unacceptable to Buyer or if Governmental Documents are not acceptable to Buyer, then Buyer shall have the right to terminate this Agreement, by written notice to Seller and the Title Company Buyer's review and acceptance or rejection of the Survey, the Commitment, Studies and Governmental Documents shall be in Buyer's sole judgment and discretion In the event of a termination of this Agreement based on such review, the Title Company shall promptly return the Earnest Money Deposit (including all accrued interest) to Buyer and the Parties shall be relieved of all further duties and obligations hereunder

4 7 Issuance of Landfill Permits Buyer's obligation to close on the purchase of the Property is contingent upon (i) the issuance by the Department of the State Permits to Buyer, or an affiliate of Buyer, authorizing Buyer or its affiliate to operate the Landfill on the Property, and (ii) the issuance by Box Elder County of the County Permit to Buyer, or an affiliate of Buyer, authorizing Buyer or its affiliate to operate the Landfill on the Property If Buyer is unable to obtain the State Permits and the County Permit on or before the Closing Date, then Buyer shall have the right, but not the obligation, to terminate this Agreement by written notice to Seller and the Title Company In such an event, the Title Company shall promptly return the Earnest Money Deposit (including all accrued interest) to Buyer and the Parties shall be relieved of all further duties and obligations hereunder

4 8 License Seller hereby grants to Buyer a license to enter and inspect the Property The Property shall be returned to its original condition upon completion of any investigations and Buyer agrees to indemnify and hold Seller harmless from and against any and all claims, costs, damages, liabilities or losses arising as a result of or in any way connected with Buyer's inspection of the Property

4 9 Seller's Obligation to Cure Buyer's Objections to Title If exceptions to the title to the Property have been raised in the Commitment or accompanying documents and if Buyer delivers written objections thereto to Seller in accordance with Section 4 6 above, then Seller shall, prior to the Closing Date, use reasonable efforts to satisfy such objections If Seller fails to cure Buyer's objections to title prior to the Closing Date, Buyer may either waive such objections or terminate this Agreement on or before the Closing Date, by written notice to Seller and the Title Company, in which event the Earnest Money Deposit (including all accrued interest) shall be returned to Buyer, and the Parties shall be released of all duties and obligations hereunder

4 10 No Condemnation or Damage Buyer shall not be obligated to purchase the Property if, prior to the satisfaction of all conditions set forth in this Article IV the Property or any portion thereof, has been condemned or sold under threat of condemnation, is the subject of

a condemnation proceeding or threat, or has been damaged by fire, earthquake or other event or occurrence. In such event, and upon written notice by Buyer to Seller and the Title Company, this Agreement shall terminate, the full amount of the Earnest Money Deposit (including all accrued interest) shall be returned to Buyer, and the Parties shall be released of all duties and obligations hereunder.

4.11 Buyer's Right to Waive Conditions Precedent. Notwithstanding anything which may be contained in this Agreement to the contrary, Buyer may, at Buyer's sole option, elect to waive any of the conditions precedent to the performance of its obligations hereunder contained in this Article IV by written notice from Buyer to Seller. In the event of any waiver of any condition precedent to Buyer's obligations hereunder, this Agreement shall continue in full force and effect with respect to all other terms, provisions and conditions herein.

4.12 Non-Refundable Earnest Money Deposit. At the conclusion of the Buyer's Review Period, if Buyer has not terminated this Agreement, then the Earnest Money Deposit shall become non-refundable, except in the event of a default by Seller hereunder or the condemnation or damage of the Property under Section 4.10, above. At all time prior to the conclusion of the Buyer's Review Period the Earnest Money Deposit shall be fully refundable to Buyer, together with all accrued interest thereon, in the event of any termination of this Agreement.

4.13 Seller's Cooperation. Seller agrees to cooperate with Buyer in connection with Buyer's due diligence during Buyer's Review Period, as and when reasonably requested by Buyer.

ARTICLE V

REPRESENTATIONS, COVENANTS AND AGREEMENTS OF SELLER

5.1 Representations of Seller. Seller represents and warrants to Buyer the following as of the date this Agreement is fully executed and as of the Closing Date, except where specific reference is made to another date or dates, in which case such date or dates shall be applicable:

(a) That Seller is, or by the Closing Date will be, the sole owner of the Property, and on the Closing Date Seller will have, and will convey to Buyer by special warranty deed, title to the Property, free and clear of all conditions, exceptions, encumbrances or reservations, except the Permitted Exceptions;

(b) That Seller has not received written notice of any pending or contemplated condemnation action with respect to the Property, or any part thereof;

(c) That Seller does and will have, at the time of the Closing, the full right, power, and authority to sell and convey the Property to Buyer as provided in this Agreement and to carry out Seller's obligations hereunder;

(d) That no third Party has been granted any lease, license, or other right relating to the use or possession of the Property after the Closing Date;

(e) That the Property is not subject to claims from any persons or entities based on prior negotiations, sales, or agreements regarding the Property, and

(f) That Seller has full power and proper authority to execute this Agreement and to perform all of its terms and conditions without violation of Seller's charter documents or other contractual or legal obligations, and that all required actions necessary to authorized Seller to enter into this Agreement and to carry out its obligations hereunder have been taken

ARTICLE VI

REPRESENTATIONS COVENANTS, AND AGREEMENTS OF BUYER

6 1 Representations of Buyer Buyer represents, warrants, covenants, and agrees with Seller, as of the date this Agreement is fully executed and as of the Closing Date, that Buyer has or will have the full right, power, and authority to purchase the Property from Seller as provided in this Agreement and to carry out its obligations hereunder, and that all required action necessary to authorize Buyer to enter into this Agreement and to carry out its obligations hereunder has been taken, or upon the Closing, will have been taken

ARTICLE VII

CLOSING

7 1 Date and Place of the Closing The Closing shall take place in the offices of the Title Company, or such other location as Buyer and Seller shall agree, and shall be the earlier of (i) thirty (30) days after Buyer has obtained the State Permits and the County Permit or (ii) December 31, 2007 (the "Closing Date")

7 2 Items to be delivered at the Closing

(a) Seller On or before the Closing Date, Seller shall deliver to the Title Company each of the following items, together with instructions to deliver the same to Buyer at the Closing

(i) Special Warranty Deed to the Property, the form of which is acceptable to Buyer and the Title Company, duly executed and acknowledged by Seller, conveying good, marketable, and indefeasible fee simple title to the Property to Buyer, subject only to the Permitted Exceptions,

(ii) A certification of nonforeign status pursuant to Section 1445 of the Internal Revenue Code, in a form acceptable to Buyer and the Title Company, and

(iii) All additional documents and instruments which the Buyer or the Title Company reasonably determine to be necessary to the consummation of this transaction

(b) Buyer On or before the Closıng Date, Buyeı shall delıver to the Tıtle Company each of the followıng ıtems

(ı) Cashıer's check or bank-to-bank wıre tıansfer to the Tıtle Company for delıvery to Selleı, funds ın the sum of the Two Hundred Fıfty Thousand and No/100 Dollars ($250,000 00) (less the Earnest Money Deposıt and all accrued ınterest), plus Buyer's shaıe of closıng costs and pıoratıons, as provıded below, less all costs, expenses, and proratıons to be paıd by Seller, and

(ıı) All addıtıonal documents and instıuments whıch the Seller oı the Tıtle Company reasonably determıne to be necessary to the consummatıon of thıs transactıon

7 3 Closıng Proratıons Ad valorem and sımılar taxes and assessments relatıng to the Property shall be prorated between Seller and Buyeı as of mıdnıght of the Closıng Date, based upon the amount shown for ıeal property taxes ın the most recent tax notıce ıssued for the Property as assessed by the county assessor Seller shall also pay any roll back taxes due under the Farmland Assessment Act resultıng from any change of use of the Property occurrıng on or before the Closıng Date and shall ındemnıfy and hold harmless Buyeı fıom all such charges or taxes whenever they are levıed All other expenses of the Property shall also be prorated as of mıdnıght of the Closıng Date The provısıons of thıs Sectıon shall survıve the Closıng

7 4 Closıng Costs All escrow and closıng fees charged by the Tıtle Company shall be dıvıded equally between, and paıd by, Buyer and Seller Seller shall pay all recordıng fees Seller shall pay the premıum for the Tıtle Polıcy

ARTICLE VIII

DEFAULTS AND REMEDIES

8 1 Seller's Defaults, Buyer's Remedıes

(a) Seller's Defaults Seller shall be deemed to be ın default hereunder upon the occurrence of any one or more of the followıng events

(ı) Any of Seller's warrantıes or representatıons set forth hereın shall be or become untrue at any tıme on or before the Closıng Date,

(ıı) Seller shall faıl to meet, comply wıth, or peıform any covenant, agreement, or oblıgatıon on ıts part requıred wıthın the tıme lımıts and ın the manner requıred ın thıs Agreement

(b) Buyer's Remedıes In the event Seller shall be deemed to be ın default hereunder and so long as Buyer ıs not then ın default hereunder, Buyer may, at Buyer's sole optıon, exercıse any one or more of the followıng remedıes

(ı) Termınate thıs Agreement by wııtten notıce to Seller, ın which event the Earnest Money Deposıt (ıncludıng all accrued ınterest) shall be returned to Buyer, and the Parties shall be released of all duties, obligations or liabilities to each other hereunder, or

(ii) Obtain specific performance of this Agreement

8 2 Buyer's Default, Seller's Remedy In the event any of Buyer s warranties or representations set forth herein shall be untrue as of the Closing Date, or if all of Buyer's conditions precedent have been either satisfied or waived and Buyer shall fail to close on its purchase of the Property as set forth herein, and so long as Seller is not then in default hereunder, Seller, as its sole and exclusive remedy, shall have the right to terminate this Agreement by written notice to Buyer and the Title Company, in which event the Earnest Money Deposit shall be delivered to the Seller, together will all accrued interest thereon, and the Parties shall have no further duties or obligations to each other hereunder

ARTICLE IX

BROKERAGE COMMISSION

9 1 Indemnity Seller and Buyer represent and warrant to each other that neither has contacted any real estate broker, finder, or other Party in connection with this transaction, to whom any real estate brokerage, finder, or other fees may be due or payable with respect to the transaction contemplated hereby Seller and Buyer hereby indemnify and agree to hold each other harmless from any loss, liability, damage, cost, or expenses (including reasonable attorney's fees) related to anyone claiming a commission or fee with respect to the sale of the Property as a result of any statement, agreement, or other alleged act of the other

ARTICLE X

MISCELLANEOUS

10 1 References All references to "Article", "articles", "section", or "Sections" contained herein are, unless specifically indicated otherwise, references to Articles and Sections of this Agreement

10 2 Exhibits All references to "Exhibits" contained herein are references to exhibits attached hereto, all of which are made a part hereof for all purposes

10 3 Captions The captions, headings, and arrangements used in this Agreement are for convenience only and do not in any way affect, limit, amplify, or modify the terms and provisions hereof

10 4 Number and Gender of Words Whenever herein the singular number is used, the same shall include the plural where appropriate, and words of any gender shall include each other gender where appropriate

10 5 Attorneys' Fees If any action is brought or counsel otherwise employed to enforce this Agreement or any provision thereof, to collect damages for an alleged breach thereof, or for a declaratory judgment thereunder, the prevailing Party in such action or the Party

forced to take action that does not involve litigation shall be entitled to an allowance for reasonable attorneys' fees in addition to costs of suit

10 6 <u>Notices</u> All notices, demands, requests, and other communications required or permitted hereunder shall be in writing, and shall be personally delivered, mailed by certified or registered mail, postage prepaid, transmitted by facsimile, or sent by overnight courier service and addressed as follows

If to Buyer	Promontory Landfill, LLC Attention Jay Harwood 1515 West 2200 South, Suite C Salt Lake City, Utah 841190 Fax (801) 972-0707
If to Seller	Promontory Point Land Resources, LLC 230 West Main Street Tremonton, Utah 84337 Fax (435) _______________
If to Title Company	Integrated Title Insurance Services, LLC Attention Mike Kirby 6925 Union Park Center, Suite 160 Midvale, Utah 84047 Fax (801) 307-0170

If mailed, such communications shall be deemed to be delivered, whether actually received or not, three (3) days after deposit in a regularly maintained receptacle for the United States mail If sent by overnight courier, such communications shall be effective on the date actually delivered If sent by facsimile, such communications shall be effective on the date transmitted upon receipt of successful transmission

10 7 <u>Governing Law</u> The laws of the State of Utah shall govern the validity, construction, enforcement, and interpretation of this Agreement, unless otherwise specified herein

10 8 <u>Entirety and Amendments</u> This Agreement embodies the entire agreement between the Parties and supersedes any prior agreements and understandings, if any, relating to the Property, and may be amended or supplemented only by an instrument in writing executed by both Seller and Buyer

10 9 <u>Invalid Provisions</u> If any provision of this Agreement, except the provisions relating to Seller's obligation to convey the Property and Buyer's obligation to pay the Purchase Price, the invalidity of either of which shall cause this contract to be null and void, is held to be illegal, invalid, or unenforceable under this Agreement shall be construed and enforced as if such illegal, invalid, or unenforceable provision had never comprised a part of this Agreement, and the remaining provisions of this Agreement shall remain in full force and effect and shall not be

affected by the illegal, invalid, or unenforceable provision or by its severance from this Agreement

10 10 <u>Multiple Counterparts</u> This Agreement may be executed by facsimile and in a number of identical counterparts If so executed, each of such counterparts is to be deemed an original for all purposes, and all such counterparts shall, collectively, constitute one agreement, but in making proof of this Agreement, it shall not be necessary to produce or account for more than one such counterpart

10 11 <u>Parties Bound</u> This Agreement is freely assignable, and shall be binding upon and inure to the benefit of Seller and Buyer, and their respective heirs, successors and assigns

10 12 <u>Further Acts</u> In addition to the acts and deeds recited herein and contemplated to be performed, executed, and delivered by Seller and Buyer, Seller and Buyer agree to perform, execute, and deliver or cause to be performed, executed, and delivered at the Closing or after the Closing any and all such further acts, deeds, and assurances as may be necessary to consummate the transactions contemplated hereby

EXECUTED as of the day and year first above written

BUYER

PROMONTORY LANDFILL, LLC

By____________________
Jay Harwood
Its Manager

SELLER

PROMONTORY POINT LAND RESOURCES, LLC

By ____________________
Name ____________________
Its Manager

Exhibit A
to
Purchase and Sale Agreement

Legal Description of the Property

The real property situated in Box Elder County, Utah, more particularly described as follows

THE EAST HALF OF THE NORTHWEST QUARTER, SECTION 19, TOWNSHIP 6 NORTH, RANGE 5 WEST, SALT LAKE BASE AND MERIDIAN

THE SOUTHWEST QUARTER OF THE NORTHWEST QUARTER, SECTION 19, TOWNSHIP 6 NORTH, RANGE 5 WEST, SALT LAKE BASE AND MERIDIAN

THE SOUTHWEST QUARTER, SECTION 19, TOWNSHIP 6 NORTH, RANGE 5 WEST, SALT LAKE BASE AND MERIDIAN

THE WEST HALF OF THE NORTHEAST QUARTER, SECTION 30 TOWNSHIP 6 NORTH, RANGE 5 WEST, SALT LAKE BASE AND MERIDIAN

THE WEST HALF OF THE NORTHWEST QUARTER, SECTION 30, TOWNSHIP 6 NORTH, RANGE 5 WEST, SALT LAKE BASE AND MERIDIAN

THE SOUTHEAST QUARTER, SECTION 13, TOWNSHIP 6 NORTH, RANGE 6 WEST, SALT LAKE BASE AND MERIDIAN

THE SOUTHEAST QUARTER OF THE SOUTHEAST QUARTER OF THE SOUTHEAST QUARTER, SECTION 14, TOWNSHIP 6 NORTH, RANGE 6 WEST, SALT LAKE BASE AND MERIDIAN

THE NORTHEAST QUARTER OF THE NORTHEAST QUARTER OF THE NORTHEAST QUARTER, SECTION 23, TOWNSHIP 6 NORTH, RANGE 6 WEST, SALT LAKE BASE AND MERIDIAN

THE SOUTH HALF OF THE NORTHEAST QUARTER OF THE NORTHEAST QUARTER, SECTION 23, TOWNSHIP 6 NORTH, RANGE 6 WEST, SALT LAKE BASE AND MERIDIAN

THE SOUTHEAST QUARTER OF THE NORTHEAST QUARTER, SECTION 23, TOWNSHIP 6 NORTH, RANGE 6 WEST, SALT LAKE BASE AND MERIDIAN

LESS THE EXISTING COUNTY ROAD AND ALL LAND LYING WESTERLY OF SAID COUNTY ROAD

THE NORTHEAST QUARTER OF THE SOUTHEAST QUARTER, SECTION 23, TOWNSHIP 6 NORTH, RANGE 6 WEST, SALT LAKE BASE AND MERIDIAN

LESS THE EXISTING COUNTY ROAD AND ALL LAND LYING WESTERLY OF SAID COUNTY ROAD

THE SOUTHEAST QUARTER OF THE SOUTHEAST QUARTER, SECTION 23, TOWNSHIP 6 NORTH, RANGE 6 WEST, SALT LAKE BASE AND MERIDIAN

LESS THE EXISTING COUNTY ROAD AND ALL LAND LYING WESTERLY OF SAID COUNTY ROAD

THE NORTHEAST QUARTER, SECTION 24, TOWNSHIP 6 NORTH, RANGE 6 WEST, SALT LAKE BASE AND MERIDIAN

THE SOUTH HALF, SECTION 24, TOWNSHIP 6 NORTH, RANGE 6 WEST, SALT LAKE BASE AND MERIDIAN

THE NORTHEAST QUARTER, SECTION 25, TOWNSHIP 6 NORTH, RANGE 6 WEST, SALT LAKE BASE AND MERIDIAN

THE SOUTHEAST QUARTER, SECTION 25, TOWNSHIP 6 NORTH, RANGE 6 WEST, SALT LAKE BASE AND MERIDIAN

LESS THE EXISTING COUNTY ROAD AND ALL LAND LYING SOUTHERLY OF THE SAID COUNTY ROAD

THE SOUTHWEST QUARTER, SECTION 25, TOWNSHIP 6 NORTH, RANGE 6 WEST, SALT LAKE BASE AND MERIDIAN

LESS THE EXISTING COUNTY ROAD AND ALL LAND LYING SOUTHWESTERLY OF SAID COUNTY ROAD

THE NORTHWEST QUARTER, SECTION 25, TOWNSHIP 6 NORTH, RANGE 6 WEST, SALT LAKE BASE AND MERIDIAN

LESS THE EXISTING COUNTY ROAD AND ALL LAND LYING SOUTHWESTERLY OF SAID COUNTY ROAD

THE WEST HALF OF THE SOUTHWEST QUARTER OF SECTION 18, TOWNSHIP 6 NORTH, RANGE 5 WEST, SALT LAKE BASE AND MERIDIAN

THE SOUTHEAST QUARTER OF THE SOUTHWEST QUARTER OF SECTION 18, TOWNSHIP 6 NORTH, RANGE 5 WEST, SALT LAKE BASE AND MERIDIAN

THE WEST HALF OF THE NORTHEAST QUARTER OF THE SOUTHWEST QUARTER, SECTION 18, TOWNSHIP 6 NORTH, RANGE 5 WEST, SALT LAKE BASE AND MERIDIAN

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THE SOUTHWEST QUARTER OF SECTION 13, TOWNSHIP 6 NORTH, RANGE 6 WEST, SALT LAKE BASE AND MERIDIAN

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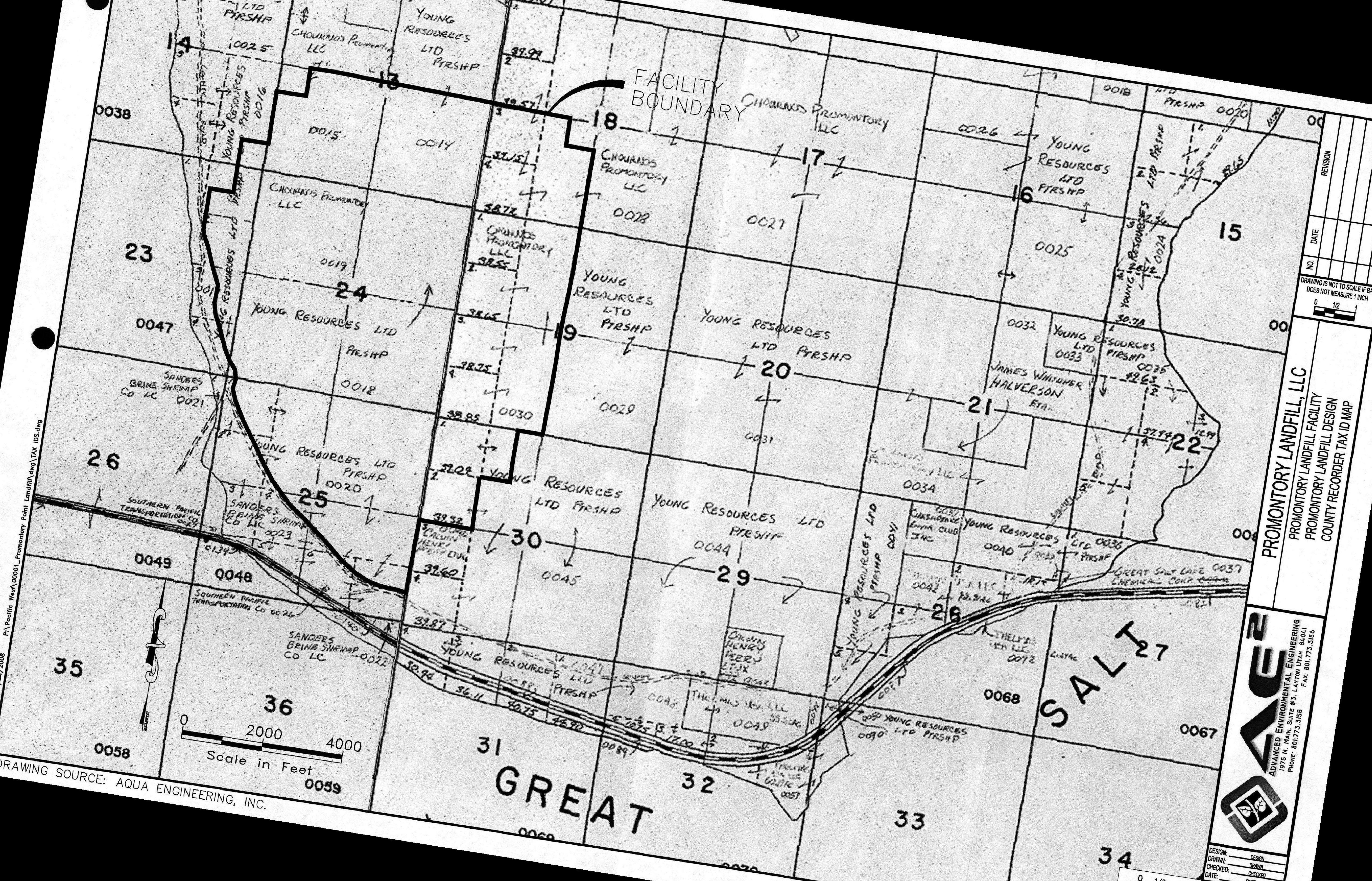
THE NORTHWEST QUARTER OF SECTION 24, TOWNSHIP 6 NORTH, RANGE 6 WEST, SALT LAKE BASE AND MERIDIAN

TOGETHER WITH ALL IMPROVEMENTS, APPURTENANCES AND ANY WATER RIGHTS THERETO BELONGING

COUNTY RECORDER TAX ID MAP


FACILITY BOUNDARY
PROMONTORY LANDFILL, LLC
PROMONTORY LANDFILL FACILITY
PROMONTORY LANDFILL DESIGN
COUNTY RECORDER TAX ID MAP
AE2
ADVANCED ENVIRONMENTAL ENGINEERING
1975 N. MAIN, SUITE #3, LAYTON UTAH 84041
PHONE: 801.773.3155 FAX: 801.773.3156
NO. DATE REVISION
DRAWING IS NOT TO SCALE IF BAR DOES NOT MEASURE 1 INCH
DESIGN: DRAWN: CHECKED: DATE:
0 2000 4000
Scale in Feet
DRAWING SOURCE: AQUA ENGINEERING, INC.
P:\Pacific West\00001_Promontory Point Landfill\dwg\TAX IDS.dwg
GREAT SALT
YOUNG RESOURCES LTD PTRSHP
CHOURADS PROMONTORY LLC
SANDERS BRINE SHRIMP CO LC
SOUTHERN PACIFIC TRANSPORTATION CO
JAMES WHITNER HALVERSON ETAL
GREAT SALT LAKE CHEMICAL CORP.
CALVIN HENRY PEERY ETUX
THELMAS ISH LLC
13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36

APPENDIX D
GEOTECHNICAL AND GEOLOGIC STUDY

AGEC Report

Applied Geotechnical Engineering Consultants, Inc

October 20, 2009

Shoshone Environmental
770 East South Temple Suite 100
Salt Lake City, UT 84102

Attention Tony Hiatt
EMAIL thiatt@nwbshoshone-nsn gov

Subject Geotechnical Consultation
Response to Geotechnical-Related Comments from the State of Utah
Promontory Point Landfill
Box Elder County Utah
Project No 1090592

Gentlemen

Applied Geotechnical Engineering Consultants, Inc was requested to respond to a comment from the State of Utah relating to the draft geotechical report prepared by AGEC for the Promontory Point Landfill permit application Our services are provided in general accordance with our proposal dated August 26, 2009

BACKGROUND

AGEC previously provided a draft geotechnical and geologic study for Aqua Engineenng, Inc for the Promontory Point Landfill permit application Our findings are presented in a report dated June 19, 2003 under Project No 1020875

Based on an email received on April 30, 2009 from Advanced Environmental Engineenng, we understand that the State of Utah Department of Environmental Quality had the following review comment

> *<u>Long term - Closure</u>, results of a pseudo static analysis indicate that a small to moderate displacement of 15 cm for a 4 1 slope is likely Please provide a brief explanation or literature (one page or less would be sufficient) on how these conditions and results are acceptable and are safe landfill construction standards "*

SCOPE

AGEC was requested to review the information presented in the above-referenced report relative to the State's comment Literature review and a review of the analysis previously conducted by AGEC was performed to provide a response to the comment

RESPONSE

Our analysis presented in the above referenced report indicates that up to approximately 15 cm (approximately 6 inches) of movement may occur for the final closure under the considered design seismic event based on the following assumptions

- Peak horizontal ground acceleration is 0 55g (event having a 10 percent probability of occurring in 250 years)
- A final closure slope of 4 horizontal to 1 vertical
- Waste and weakest interface to have minimum strength based on a friction angle of 25 degrees

Literature reviewed indicates that displacement on the order of 6 inches is typically considered acceptable for well-designed, lining systems Greater displacements of up to 12 inches may be acceptable where it is judged that the lining system can sustain this level of movement without failure Slightly greater displacement may be considered for final cover liners assuming that the damage can be observed and the cover is accessible for repair should damage occur as a result of a major seismic event (Seed and Bonaparte,1992)

Design case histories for hazardous waste landfills are discussed by Kavazanjian and Matasovic (2001) The information presented indicates that cover systems for the case histories presented are designed for permanent seismic displacement of 30 cm (approximately 12 inches)

Based on our review of *RCRA Subtitle D (258) Seismic Design of Municipal Solid Waste Landfill Facilities* (EPA, 1995, p 108), 15 to 30 cm of permanent seismic displacement is typically used in practice for design of geosynthetic liner systems The guidance document indicates that "for cover systems, where permanent seismic deformations may be observed in post-earthquake inspections and damage to components can be repaired, larger permanent deformations may be considered acceptable'

Based on our review of the analysis performed by AGEC and the review of literature as discussed above, it is our professional opinion that the estimated seismic deformation for the proposed landfill closure is an acceptable amount It is consistent with, and in some cases less than what is typically used in design for municipal solid waste landfill covers

If you have any questions or if we can be of further service, please call

Sincerely,

APPLIED GEOTECHNICAL ENGINEERING CONSULTANTS, INC

PROFESSIONAL ENGINEER
10/20/09
JAY R
MCQUIVEY
No 177862 2202
STATE OF UTAH

Jay R McQuivey, P E

Reviewed by DRH, P E , P G
JRM/dc

References

EPA (1995), "RCRA Subtitle D (258) Seismic Design Guidance for Municipal Solid Waste Landfill Facilities', EPA/600/R-95/051

Kavazanjian, E and Matasovic, N "Seismic Design of Mixed and Hazardous Waste Landfills", Fourth International Conference on Recent Advances in Geotechnical Earthquake Engineering and Soil Dynamics and Symposium in Honor of Professor W D Liam Finn, San Diego, California, March 26-31, 2001

Seed R B and Bonaparte, R (1992), "Seismic Analysis and Design of Lined Waste Fills Current Practice," Proc *Stability and Performance of Slopes and Embankments - II,* Vol 2, ASCE Geotechnical Special Publication No 31, Berkeley, California, pp 1521 1545

Applied Geotechnical Engineering Consultants Inc

GEOTECHNICAL AND GEOLOGIC STUDY

PROMONTORY LANDFILL, LLC
CLASS I LANDFILL

PERMIT APPLICATION

BOX ELDER COUNTY, UTAH

PREPARED FOR

AQUA ENGINEERING INC
533 WEST 2600 SOUTH, SUITE 275
BOUNTIFUL, UTAH 84010

ATTENTION   CRAIG NEELEY/CHET HOVEY

PROJECT NO 1020875   JULY 21, 2003

600 West Sandy Parkway • Sandy Utah 84070 • (801) 566-6399 • FAX (801) 566-6493

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EXECUTIVE SUMMARY

1 The site is suitable for the proposed construction The natural soil and bedrock encountered at the site are suitable for support of the proposed landfill

2 The subsurface conditions encountered in the test pits consist of topsoil overlying clay in the upper 1 to 5 feet or sand and gravel Clay layers up to approximately 11½ feet thick were encountered at depth in 4 of the explorations

Bedrock was encountered below the topsoil in one exploration and at depths of approximately 1 to 14 feet in 14 of the explorations Possible bedrock was encountered in two of the explorations at depths of 7 and 14 feet

Subsurface conditions encountered in Monitor Well MW-1 consist of sand and gravel extending to a depth of approximately 43 feet below the ground surface overlying bedrock which extended the full depth of the monitor well, approximately 61½ feet The subsurface conditions encountered in Monitor Wells MW-2 through MW-4 consisted of sand and gravel with occasional thin clay layers extending to the maximum depth investigated approximately 100 feet below the ground surface Subsurface conditions encountered in Monitor Well MW-5 consist of sand and gravel with occasional clay layers extending to a depth of approximately 41 feet below the ground surface overlying bedrock to the maximum depth of the monitor well, approximately 243 feet

3 No subsurface water was encountered in the test pits at the time of excavation Subsurface water was measured at depths of approximately 33, 32½,32, 36 and 219 feet below the ground surface in Monitor Wells MW-1 through MW-5, respectively, based on measurements taken June 18, 2003

4 Excavation of the overburden soil at the site, with the exception of cemented layers, may be accomplished with conventional excavation equipment Cemented layers and bedrock may require heavy-duty ripping or possibly blasting to excavate significant depths into the material

Executive Summary Continued

5 The on-site materials may be utilized for construction of the landfill Soil and bedrock which can be adequately broken down into appropriate particle sizes may be utilized as soil cover material The on site gravel may be considered for use as drainage material if it has less than 5 percent passing the No 200 sieve

6 The slope of the waste and closure material may be constructed at slopes of 4 horizontal to 1 vertical or flatter Stability analysis indicates a safety factor of 1 9 under static conditions A pseudo-static analysis was conducted for a seismic event having a 2 percent probability of exceedance in a 50 year period The analysis indicates a small to moderate amount of displacement is likely under this seismic condition with predicted movement on the order of 15 centimeters for slopes constructed at 4 horizontal to 1 vertical Waste and closure material interfaces having a friction angle of 25 degrees or higher were assumed

7 Settlement analysis was conducted for the landfill foundation assuming the final configuration with 4 horizontal to 1 vertical slopes on the closure cap and assuming approximately 10 feet of soil is removed Settlement on the order of 10 inches is estimated for the central portion of the landfill area once full loading conditions have been achieved Settlement is estimated to be less than 2 inches around much of the perimeter of the landfill due to the presence of shallow bedrock The predicted magnitude of settlement resulting from the completed landfill is presented on Figure 26 An additional 0 to 6 inches of bedrock strain is estimated under the load of the landfill and is not included in the settlement estimates on Figure 26

8 There are no geologic hazards which will be of concern for the proposed development with the exception of strong ground shaking due to earthquake activity

9 Geologic conditions, materials and construction precautions are contained in the report

SCOPE

This report presents the results of a geotechnical and geologic study for the permit application for the proposed Promontory Point Landfill to be located on the southwest portion of the Promontory Point Peninsula in Box Elder County, Utah The report presents the subsurface conditions encountered, laboratory test results and geotechnical recommendations for design and construction of the proposed landfill The study was conducted in general accordance with our proposals dated December 18, 2002 and February 5 and February 12, 2003 A letter containing preliminary information was previously presented and is dated December 30, 2002

Field exploration was conducted to obtain information on the subsurface conditions Samples obtained from the field investigation were tested in the laboratory to determine physical and engineering characteristics of the on site materials Information obtained from the field and laboratory was used to define conditions at the site for our engineering analysis and to develop recommendations for the proposed landfill

This report has been prepared to summarize the data obtained during the study and to present our conclusions and recommendations based on the proposed construction and subsurface conditions encountered Design parameters and a discussion of geotechnical engineering considerations related to construction are included in the report

SITE CONDITIONS

The following is a brief description of the site at the time of our field study

The site is located at the southeast edge of the promontory mountains near Saline, Utah The site consists of open range land There are no existing structures or pavement on the site There is an existing water well on the site

There are several small fill piles of trash near Test Pit TP-26 Two abandoned cars are located between Test Pits TP-21 and TP-22

Several overhead utility lines extend through the site

There are rock outcrops on the east and west portions of the site

Two large drainages and several smaller drainages are located in the central portion of the site The site slopes gently to moderately down to the south/southwest

The site is vegetated with grasses, weeds and sagebrush

FIELD STUDY

Test Pits TP-1 through TP-27 were excavated at the site on December 11 12, 13, and 16, 2002 These test pits were excavated throughout a 1,000 acre area considered for the proposed facility Test Pits A-1 through A-9 were excavated on December 23, 2002 The test pits were excavated using a track-mounted backhoe provided by the client

Monitor Wells MW 1 through MW-4 were drilled and installed on January 23, 24, 27, 28 and 29, 2003, with 4 inch Odex drilling system Monitor Well MW-5 was dnlled and installed May 14 through May 21 2003 with 8 inch Odex/air rotary methods

The monitor wells were drilled and test pits excavated at the approximate locations indicated on Figure 2 Test pits and monitor wells were logged and soil and bedrock samples obtained by a geologist from AGEC Logs of subsurface conditions encountered during drilling of the monitor wells and logs of the monitor wells as installed are presented on Figures 3 through 8 Logs of the subsurface conditions encountered in the test pits are presented on Figure 9 through 12 Legend and notes of the monitor wells and test pits are shown on Figure 13

SUBSURFACE CONDITIONS

The subsurface conditions encountered in the test pits consist of approximately 2 to 9 inches of topsoil overlying clay in the upper 1 to 5 feet of Test Pits TP 1, TP-2, TP-8, TP-11, TP-20, TP-21, TP-22 and A-1 and sand and gravel in the other test pits Clay layers up to approximately 11 ½ feet thick were encountered at depth in Test Pits TP-11, TP-23, A-4 and A-8

Bedrock was encountered below the topsoil in Test Pit TP-4 and at depths of approximately 1 to 14 feet in Test Pits TP-6 TP-8, TP 12, TP-15, TP-16, TP-19, TP-21 TP-22, TP 24, TP-25, A-1, A-2, A-3 and A-5 Possible bedrock was encountered in Test Pits TP-18 and TP-27 at depths of 14 and 7 feet, respectively

Subsurface conditions encountered in Monitor Well MW-1 consist of sand and gravel extending to a depth of approximately 43 feet below the ground surface overlying bedrock which extended the full depth of the monitor well, approximately 61 ½ feet The subsurface conditions encountered in Monitor Wells MW-2 through MW 4 consisted of sand and gravel with occasional thin clay layers extending to the maximum depth investigated, approximately 100 feet below the ground surface Subsurface conditions encountered in Monitor Well MW-5 consist of sand and gravel with occasional clay layers extending to a depth of approximately 41 feet below the ground surface overlying bedrock to the maximum depth of the monitor well, approximately 243 feet

A description of the various materials encountered in the test pits and borings for monitor wells is indicated below

Topsoil - The topsoil consists of silty and clayey sand and gravel to lean clay Cobbles and occasional boulders were encountered in the topsoil The topsoil is slightly moist, brown and contains roots

Lean Clay - The clay contains small to moderate amounts of gravel The clay is porous in Test Pits TP-1, TP 2 and A-1 The clay contains cobbles and occasional boulders up to 3 feet in size It is stiff to very stiff, slightly moist and wet at depth in the bonngs It is brown to reddish brown to grayish brown in color

Laboratory tests conducted on samples of the clay indicate natural moisture contents range from 8 to 18 percent and natural dry densities range from 74 to 113 pounds per cubic foot (pcf)

Consolidation tests conducted on samples of the clay indicate that the soil will compress a moderate amount with the addition of moderate to heavy loads Results of the consolidation tests are presented on Figures 14 through 19 Some of the clay in the upper approximate 4 feet such as in Test Pit TP-1 is moisture sensitive, becoming more compressible when wetted We anticipate that the upper clay will be removed from below the proposed landfill

Clayey Sand with Gravel - The sand contains clayey gravel layers, cobbles and occasional boulders up to 1 ½ feet in size It is medium dense to dense, slightly moist to moist and brown in color

Results of laboratory tests conducted on samples of the clayey sand indicate a natural moisture content of 5 percent and a natural dry density of 90 pcf

The results of a gradation test conducted on a sample of the clayey sand are presented on Figure 23 The results of gradation and moisture density relationship (Proctor) tests conducted on samples ranging from sandy silt clay to clayey gravel with sand are presented on Figures 24 and 25

A consolidation test conducted on a sample of the clayey sand indicates that the soil will compress a small to moderate amount with the addition of moderate to heavy loads Results of the test are presented on Figure 18 The upper approximate 4 feet in some areas such as Test Pit TP-20 is moisture sensitive, becoming more compressible when wetted We anticipate that the upper material will be removed from below the proposed landfill

A sample of the sandy, silty clay was remolded to 95 percent of the maximum dry density as determined by ASTM D-698 and a permeability test conducted on a remolded sample The test results indicate a permeability of 1 x 10 ^{5} centimeters per second

<u>Silty Sand with Gravel</u> - The sand contains clayey layers and gravel layers Occasional cemented layers cobbles and occasional boulders were encountered The sand is medium dense to very dense, slightly moist and brown to reddish brown in color

Laboratory tests conducted on samples of the silty sand indicate natural moisture contents range from 3 to 6 percent and natural dry densities range from 97 to 124 pcf The results of a gradation test conducted on a sample of the sand are presented on Figure 21

Poorly Graded Sand with Gravel - The sand contains gravel layers, cobbles and occasional boulders Occasional cemented layers were encountered The sand is medium dense to very dense, slightly moist to moist, wet at depth in the borings and brown to grayish brown to reddish brown in color

The results of laboratory tests conducted on a sample of the sand indicate a natural moisture content of 7 percent

The results of gradation tests conducted on samples of the sand are presented on Figures 20, 21 and 22

Clayey Gravel with Sand and Clayey Sand with Gravel - The sand and gravel is interlayered It contains cobbles and occasional boulders and occasional clay layers It is dense to very dense, slightly moist to moist, wet at depth in the bonngs and brown to gray in color

Laboratory tests conducted on samples of the sand and gravel indicate natural moisture contents range from 4 to 13 percent and natural dry densities range from 114 to 130 pcf

Clayey Gravel with Sand - The gravel contains clayey sand layers and occasional clay layers Cobbles and boulders up to approximately 2 feet in size and occasional cemented layers were encountered The gravel is medium dense to very dense, slightly moist to moist, wet at depth in the borings and brown to gray in color

Laboratory tests conducted on samples of the gravel indicate natural moisture contents range from 8 to 13 percent and a natural dry density of 120 pcf

The results of a gradation test conducted on a sample of the clayey gravel are presented on Figure 20

Silty Gravel with Sand - The gravel contains silty sand layers, cobbles up to approximately 1 foot in size and occasional cemented layers It is dense to very dense, slightly moist and brown in color

Poorly Graded Gravel with Sand The gravel contains sand layers, occasional cemented layers cobbles and boulders up to approximately 2 feet in size It is medium dense to very dense, slightly moist to moist, wet at depth in the borings and brown to grayish brown in color

The results of gradation tests conducted on samples of the gravel are presented on Figures 22 and 23

Bedrock - The bedrock consists of quartzite and dolomite It is hard to very hard dry to wet grayish white to gray to purple in color

Results of the laboratory tests are included on logs of the borings and test pits and are summarized on Table I

SUBSURFACE WATER

No subsurface water was encountered in the test pits at the time of excavation Subsurface water was measured at depths of approximately 33 35, 33, 35 and 220 feet below the ground surface in Monitor Wells MW-1 through MW-5, respectively, based on measurements taken at the time of drilling

There is an existing well on the site near Test Pit TP-17 which is an approximate 6 inch diameter, steel cased well with a submersible pump Based on the contours shown on Figure 2, we estimate the well to have an elevation of approximately 4330 feet Water was measured in the well on January 28, 2003 and again on June 18, 2003 at a depth of approximately 120 feet below the ground surface

PROPOSED CONSTRUCTION

We understand that the facility encompasses approximately 2 006 acres and the proposed Class 1 landfill will encompass approximately 1,000 acres

We understand that the proposed construction will include liner systems overlain by municipal solid waste with a closure cap We understand that the liner system will be constructed over the on-site soil or bedrock The liner system will consist of the following from top to bottom

- non-woven geosynthetic fabric
- gravel
- non-woven geosynthetic fabric
- geosynthetic membrane liner
- geosynthetic clay liner (GCL)

Municipal waste will be placed above the liner system The closure cap will consist of the following from top to bottom

- soil cover
- geosynthetic drainage net
- textured geosynthetic membrane liner
- geosynthetic clay liner (GCL)

We understand that the waste and closure cap will have a slope of 4 horizontal to 1 vertical

We anticipate that the site will be excavated on the order of 10 to 15 feet below the existing grade prior to constructing the lining systems We understand that permanent excavation slopes for landfill lining systems will be cut at 3 horizontal to 1 vertical or flatter If the proposed construction is different from what is described above, we should be notified to reevaluate our recommendations

GEOLOGY

A Regional Geology

The Promontory Mountains are a part of the Basin and Range Province The province is made up of north/south elongated mountain blocks and valleys The Promontory Mountains form one of the mountain blocks in the province with the Great Salt Lake occupying a portion of the valleys on either side

The valleys were once occupied by a large lake known as Lake Bonneville during the Wisconsin Glacial period of the Pleistocene Age The present day Great Salt Lake is a remnant of ancient Lake Bonneville Stillstands of Lake Bonneville formed benches along the margins of the mountain blocks The highest level of Lake Bonneville is marked by a bench, the Bonneville shoreline, at approximate elevation 5280 feet The lake remained at this high level from approximately 17,000 to 15,000 years before present (B P) until it dropped approximately 350 feet during a catastrophic flood known as the Bonneville Flood (Currey and Oviatt, 1985 and Jarrett and Malde, 1987) Two lower stillstands of Lake Bonneville are the Provo (approximately 13,000 years B P) and Gilbert (approximately 10,000 years B P) which formed at approximate elevations 4930 and 4330 feet, respectively (Currey and others, 1983) The most recent high-water level, known as the Holocene High, occurred approximately 2,600 years B P with an approximate elevation of 4220 feet

The site is at an elevation ranging from approximately 4230 feet to 5200 feet, placing the site between just above the Holocene High to just below the Lake Bonneville shoreline

B Stratigraphy

The Quaternary sediments at the site consist predominantly of Lake Bonneville deposits with a thin veneer of alluvium and colluvium Bedrock in the area consists of Cambrian and Pre-Cambrian-aged rock (Crittenden, 1988)

The Quaternary sediments consist predominantly of sand and gravel representing primarily transgressive phases of Lake Bonneville shoreline deposits Some clay was encountered at the site which generally represents deeper lake sediments deposited during the high stands of Lake Bonneville

Four bedrock formations have been mapped within the property boundaries (see Figure 1) The youngest of these deposits is the middle and lower Cambrian-aged limestone and shale consisting of interbedded, thin bedded, medium-gray, limestone and olive drab shale

The interbedded limestone and shale is underlain by lower Cambrian-aged Geertsen Canyon Quartzite which consists of deep reddish-black hematitic quartzite

The Geertsen Canyon Quartzite is underlain by the late Proterozoic-aged Browns Hole Formation which consists of pale-gray, very-fine grained vitreous quartzite

The late Proterozoic-aged Mutual Formation underlays the Browns Hole Formation and consists of thick-bedded, coarse grained quartzite intercalated with a few beds of siltstone and shale

C Structure

Due to the age of the bedrock, the bedrock is highly faulted, fractured and deformed The attitude of beds varies significantly across the site The dip of beds northeast of the site is generally down toward the northeast with a dip angle ranging from 30 to 45 degrees

D Tectonic Setting

The Promontory Mountains are bounded on the west by a fault known as the East Great Salt Lake Fault (Hecker, 1993) The fault is mapped to extend within approximately 800 feet west of the west edge of the property The East Great Salt Lake Fault is considered to have had movement within the Quaternary and possibly within the Holocene time period Quaternary slip rates for the fault are estimated to be on the order of 0 4 to 0 7 millimeters per year which is approximately half the slip rate for the Wasatch Fault (Pechmann, 1987)

A recent study (Dinter and Pechmann, 1998) using seismic reflection methods found the East Great Salt Lake Fault to be approximately 2 miles west of the southwest edge of the property

E Geologic Hazards

Geologic hazards reviewed for the project consist of surface fault rupture, ground shaking, landslide, debris flow, rockfall, subsidence, dam failure flood, mining activity, salt dome and salt bed

1 <u>Surface Fault Rupture Hazard</u>

As indicated above the East Great Salt Lake Fault is estimated to extend within approximately 2 miles west of the southwest edge of the property

There is no surface evidence of the fault based on a reconnaissance of the area The presence of the fault is based on seismic reflection surveys performed at the Great Salt Lake

Based on the topography of the area the East Great Salt Lake Fault would have relative movement down on the west We would not anticipate shallow bedrock to be encountered on the west side of the fault There is bedrock exposed west of the road on the west edge of the property Based on this reasoning, the fault is located west of the road The recent seismic reflection study would indicate that the East Great Salt Lake Fault is a considerable distance west of the road Surface fault rupture is not considered a hazard at the site

2 Earthquake Ground Shaking

Ground shaking due to large earthquakes in the area is a potential hazard at the site Studies performed by the U S Geological Survey would indicate that a probablistic ground motion of 0 55g would have a 2 percent probability of occurrence in a 50 year period (Frankel, et al, 1996) The impact due to seismic ground shaking should be considered in the design of the facility

3 Landslide

There are no mapped landslides on the property based on a review of the landslide map of the Promontory Point 30 minute by 60 minute quadrangle (Harty, 1992) Some landslides are mapped north of the site in Little Valley

Based on a reconnaissance of the site and the subsurface conditions encountered in the test pits excavated at the site, landslide is not considered a hazard for the proposed development

4 Debris Flow

There are no significant drainages which extend through the site and no source for debris flow upgradient of the site Debris flow is not considered a hazard for the proposed development

5 Rockfall

The source of rock for rockfall is steep rock outcrops at Lead Mountain to the northeast of the site and minor rock cliffs and bedrock outcrops in the southeast portion of the site None of these rockfall sources are significant enough to pose a hazard for the proposed development

6 Subsidence

The overburden soil at the site generally has low compressibility characteristics The bedrock in the area consists predominantly of quartzite which has low solubility The limestone which is present in the northeast portion of the site shows no evidence of caverns or other solution features of significance A reconnaissance of the site found no evidence of depressions or other subsidence features Subsidence due to dissolution of the limestone bedrock is not considered a potential hazard at the site

7 Dam Failure Flooding

There are no dams upgradient of the site Thus, dam failure flooding is not considered a hazard

8 Mining Activity

The Promontory Mountains have been mined for lead in the past There are mine prospects northeast of the site at and around Lead Mountain Gravel and riprap for construction for the railroad causeway have been mined in the northwest portion of the property There are some mine prospects in igneous dikes which cut through the Mutual Formation in the northwest portion of the site Most mine prospects in the area appear to be shallow explorations with no evidence of significant underground mining due to the lack of mine spoil piles of significance Two mine shafts were identified by the Utah Division of Oil, Gas and Mining in 1986 just east of the gravel quarries in the northwest portion of the site and designated VO-10 and VO-201 (see attached figure) These shafts were approximately 42 feet and 102 feet deep, respectively Both shafts were filled in 1986 Mine related hazards are not considered a concern for the proposed development

9 Salt Domes and Beds

Based on a reconnaissance of the site and subsurface exploration, there is no evidence for significant salt deposits on the property Salt deposits are not expected with the type of bedrock encountered at the site Salt domes and salt beds are not considered a hazard for the proposed development

F Conclusions

Based on our geologic hazard review for the project, seismic ground shaking represents the only geologic hazard identified as a potential concern for the proposed development No other geologic features were identified which could compromise the structural integrity of the proposed facility

RECOMMENDATIONS

Based on subsurface conditions encountered, the results of laboratory testing and our understanding of geologic conditions and the proposed construction, the following recommendations are given

A Site Grading

We anticipate that cuts will generally be on the order of 10 to 15 feet below the existing grade We anticipate that there may be deeper cuts in areas with thicker overburden material We anticipate that overburden material and/or excavated bedrock will be cut and stockpiled for use as drainage and soil cover materials Processing of the on-site soil and bedrock will likely be needed to obtain suitable gradations for their intended use in constructing the landfill

1 Excavation

Excavation of the overburden material, with the exception of highly cemented layers, can generally be accomplished with conventional excavation equipment Highly cemented soil layers and excavations extending significant depths into the bedrock may require heavy-duty ripping and/or blasting

Temporary unretained excavation slopes in the overburden material may be constructed at 1½ horizontal to 1 vertical or flatter Temporary unretained excavation slopes in bedrock may be constructed at ½ horizontal to 1 vertical or flatter

2 Subgrade Preparation

Prior to placing the geosynthetic clay liner, the subgrade should be cut to undisturbed, natural soil or bedrock Loose or disturbed soil should be removed or compacted to at least 95 percent of the maximum dry density as determined by ASTM D-698 The moisture of the subgrade, where re-compacted, should be adjusted to within 2 percent of the optimum moisture content

The subgrade should be relatively smooth prior to placing the geosynthetic clay liner This may result in the need for some over-excavation and replacement with compacted fill where cobbles, boulders or significant irregularities in the bedrock are encountered

3 Materials

The on-site soil and bedrock, which can be adequately broken down may be used in the construction

We anticipate that on-site soils will be suitable for use as soil cover Select on-site material or processed material could be used for drainage layers Drainage matenal should have no more than 5 percent passing the No 200 sieve

4 Compaction

Materials placed in landfill foundation areas should be compacted to at least 95 percent of the maximum dry density as determined by ASTM D-698 Protective soil cover should be compacted to at least 90 percent of the maximum dry density as determined by ASTM D-698 The fill should be compacted at a moisture content within 2 percent of the optimum moisture content to facilitate the compaction process

Care will be required when placing soil cover and drainage matenals over the membrane liners Adequate thickness of soil should be placed over the liners prior to using equipment above the liner The size of equipment should be restricted so as not to damage the liner

B Stability

1 Short Term - During Operation

We understand that landfill lining systems will be constructed on cut slopes of 3 horizontal to 1 vertical and waste placed over these areas Stability of these slopes should be maintained by extending the waste and cover materials out laterally a sufficient distance beyond the toe of the slopes during construction and operation

The friction angle between components of the lining system should be considered in establishing the criteria for waste placement on the slopes

2 <u>Long Term - Closure</u>

We understand that the exterior slope of the proposed landfill will have a final slope of 4 horizontal to 1 vertical Stability analysis was conducted assuming the municipal solid waste to have a friction angle of 25 degrees (Singh and Murphy, 1990) We have assumed that friction angles between components of the closure cap will be at least 25 degrees or more The friction angles between components of the closure cap should be verified and considered in the design

An infinite slope method of analysis was used Under static conditions, the analysis indicates a safety factor of 1 9

A pseudo-static analysis was conducted using a peak horizontal ground acceleration of 0 55g for a seismic event having a 2 percent probability of exceedance in a 50 year period (10 percent in 250 years) and estimating deformation due to ground shaking The results of the analysis indicate a small to moderate displacement is likely under this seismic condition with predicted movement on the order of 15 cm for a 4 horizontal to 1 vertical slope

The analysis conducted is a screening analysis presented by Bray, et al , 1998, from "Simplified Seismic Design Procedure for Geosynthetic-Lined Solid-Waste Landfills" A 50 percent confidence threshold was used (Blake, T F , et al , 2002)

Protection from erosion will be important for maintaining long term stability of the closure We understand that drainage and erosion protection are being addressed by the design civil engineer

Results of the stability analysis are included in the Appendix

C Settlement

Settlement calculations were conducted for overburden soil based on the anticipated closure with 4 horizontal to 1 vertical slopes and assuming 10 feet of material is excavated and removed Contours representing the calculated settlement are presented on Figure 26

The settlement does not include bedrock strain We estimate bedrock strain under the load of the landfill to be on the order of 0 to 6 inches

Settlement calculations are included in the Appendix

LIMITATIONS

This report has been prepared in accordance with generally accepted geotechnical engineering and geology practices in the area for the use of the client for design purposes The information presented is based on the review of geologic literature, excavation of test pits at the approximately locations indicated on Figure 2, subsurface conditions encountered in drilling for five monitor wells at the approximate locations indicated on Figure 2 and the results of laboratory testing Variations in the subsurface materials may not become evident until additional exploration or excavation is conducted If the proposed construction or subsurface conditions are significantly different from those described above, we should be notified so that we can reevaluate our recommendations

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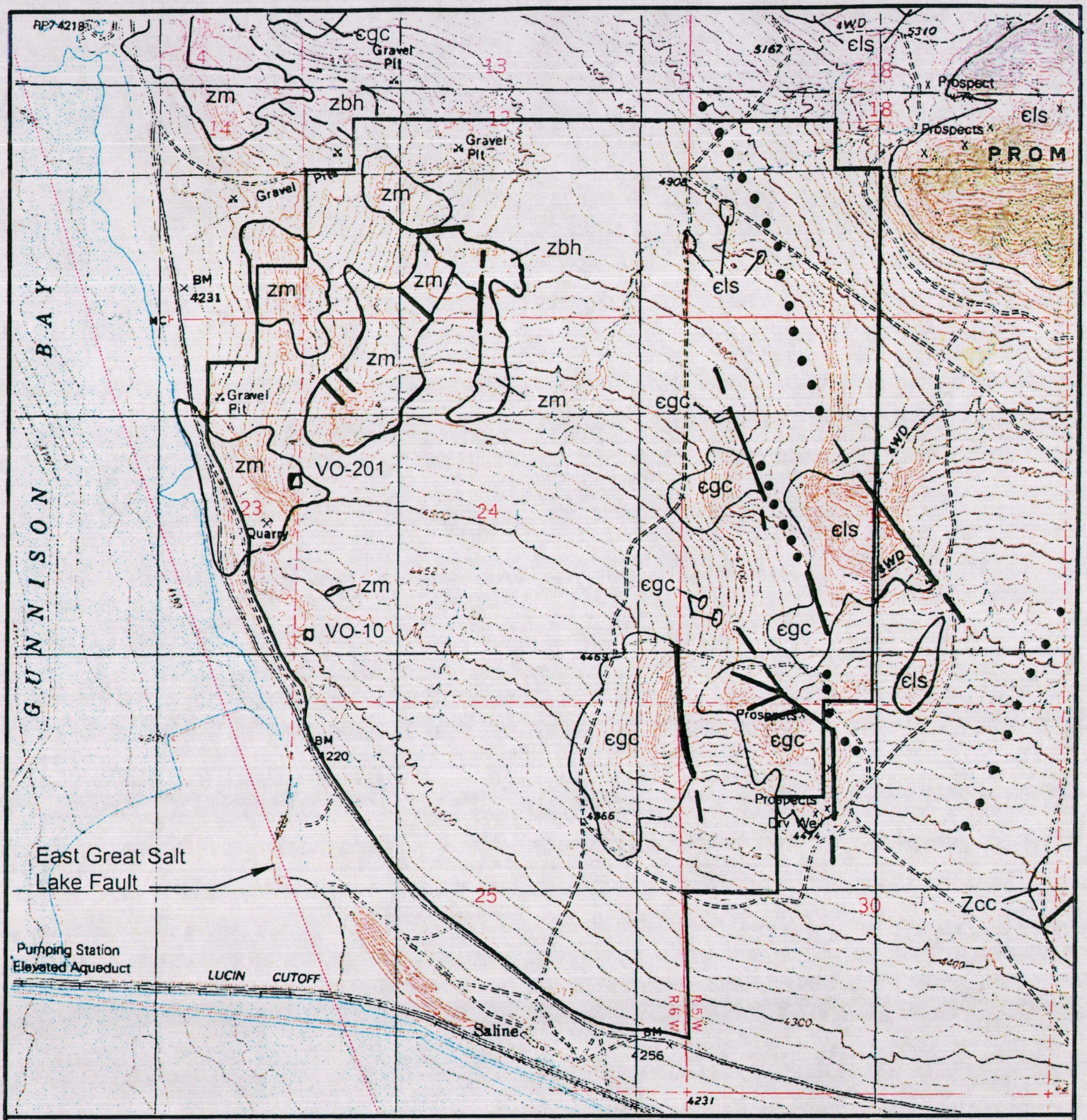


Topographic base from USGS Promontory Point and Pokes Point Quadrangles.
Geology from Crittenden, 1988.

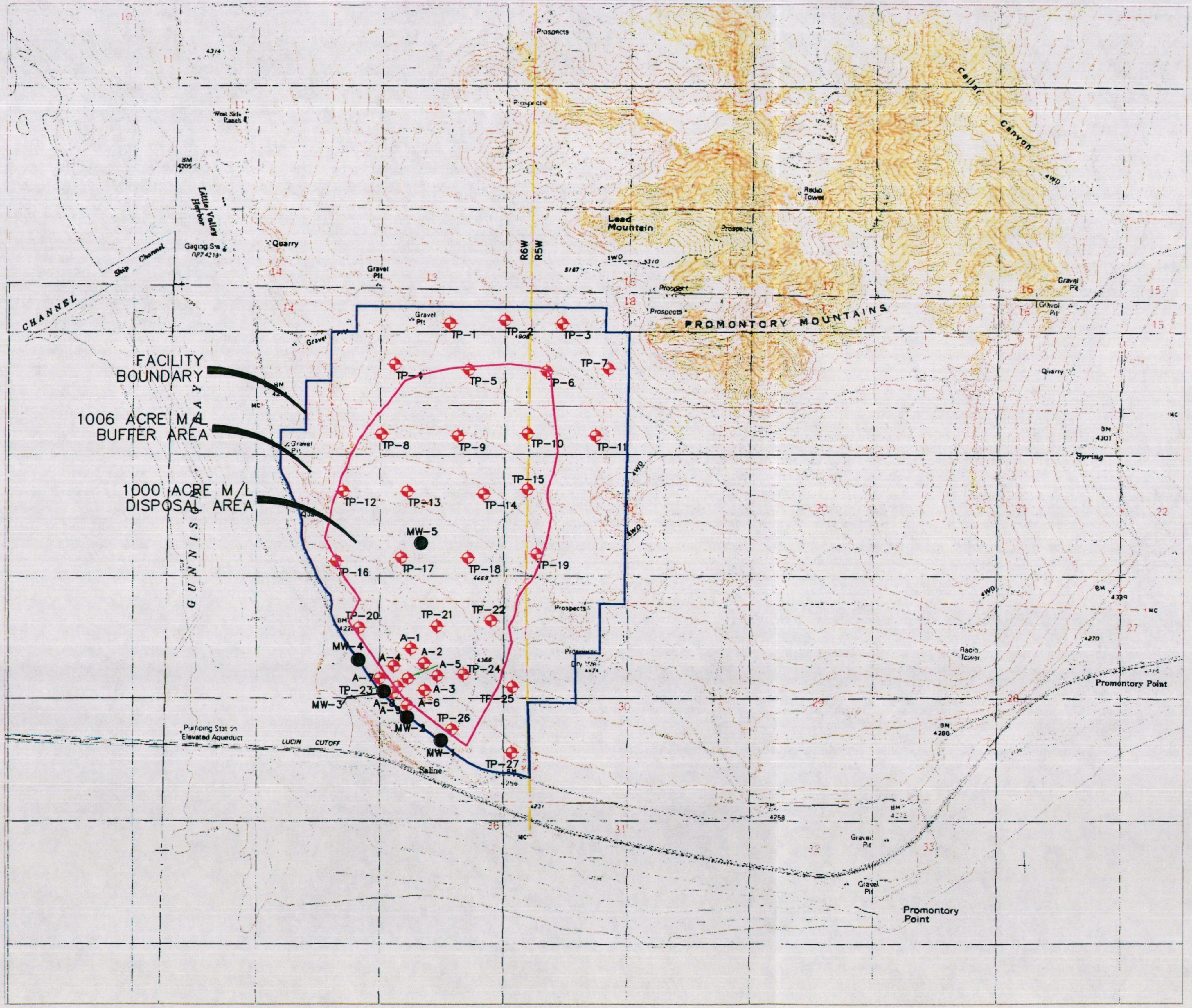
Promontory Landfill Site
Box Elder County, Utah

N

Approximate Scale
1 inch = 2,000 feet

Legend:
ɛls - Limestone and Shale (middle and lower Cambrain)
ɛgc - Geertsen Canyon Quartzite (lower Cambrain)
zbh - Browns Hole Formation (late Proterozoic)
zm - Mutual Formation (late Proterozoic)
——— Contact
—— · · · Fault
▢ VO-201 Mine Shaft filled

1020875	AGEC	**Geologic Map**	**Figure 1**



N

0 3000 6000 feet

Approximate Scale

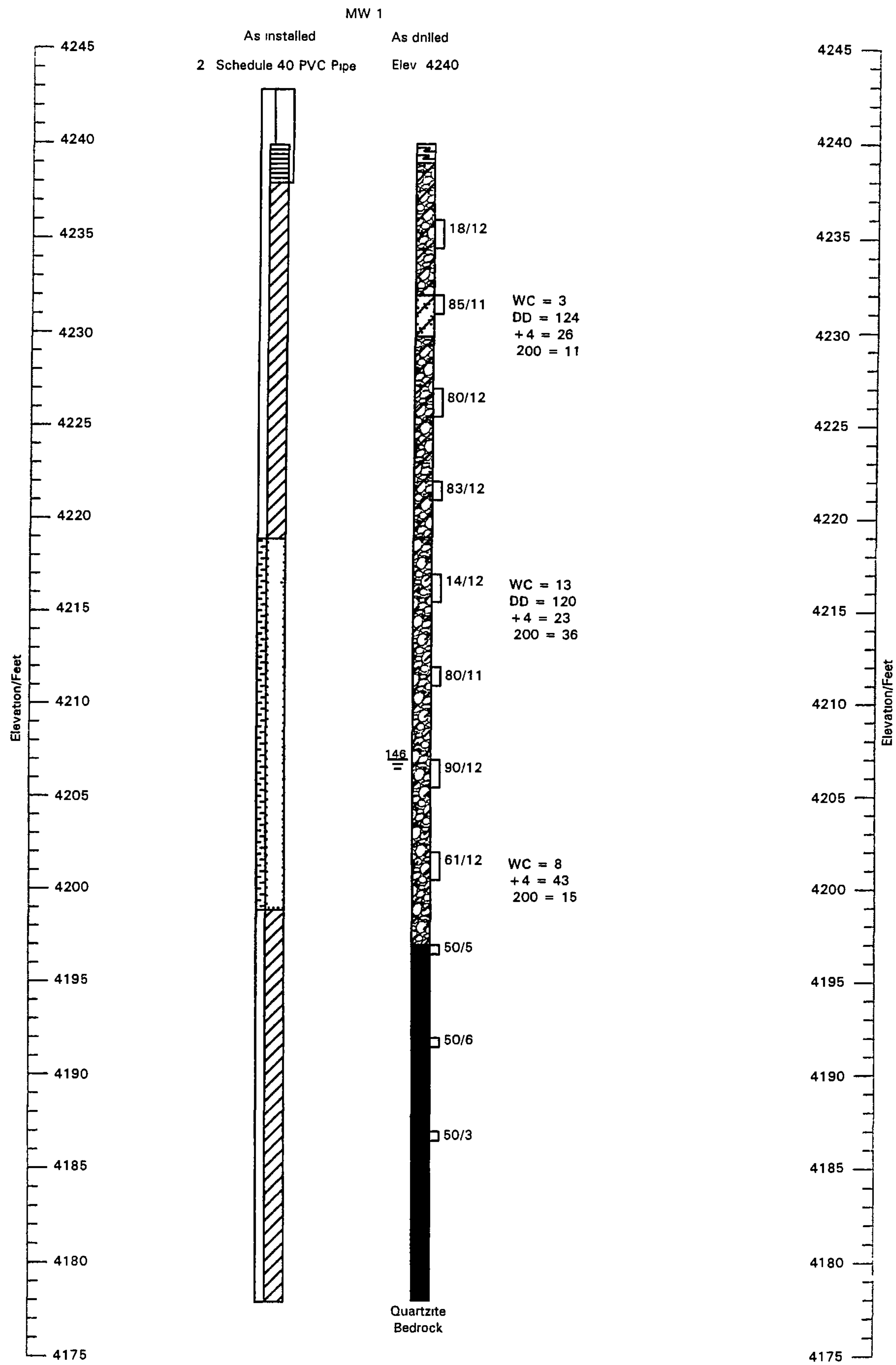
PROMONTORY POINT LANDFILL
BOX ELDER COUNTY, UTAH

Legend:

Test Pit Location

Monitor Well Location

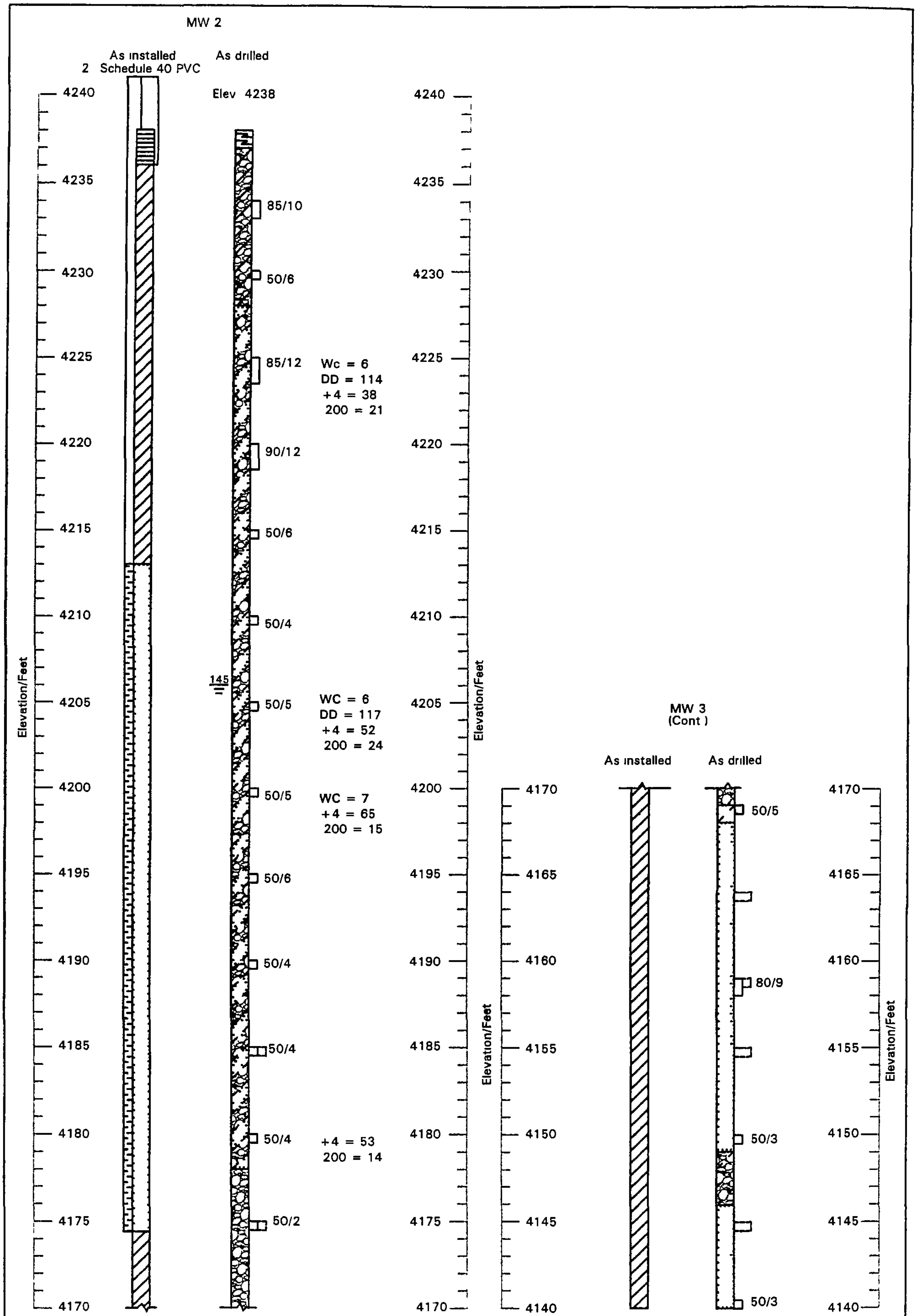
1020875		Locations of Monitor Wells and Test Pits	Figure 2



Approximate Vertical Scale 1 = 8

See Figure 13 for Legend and Notes

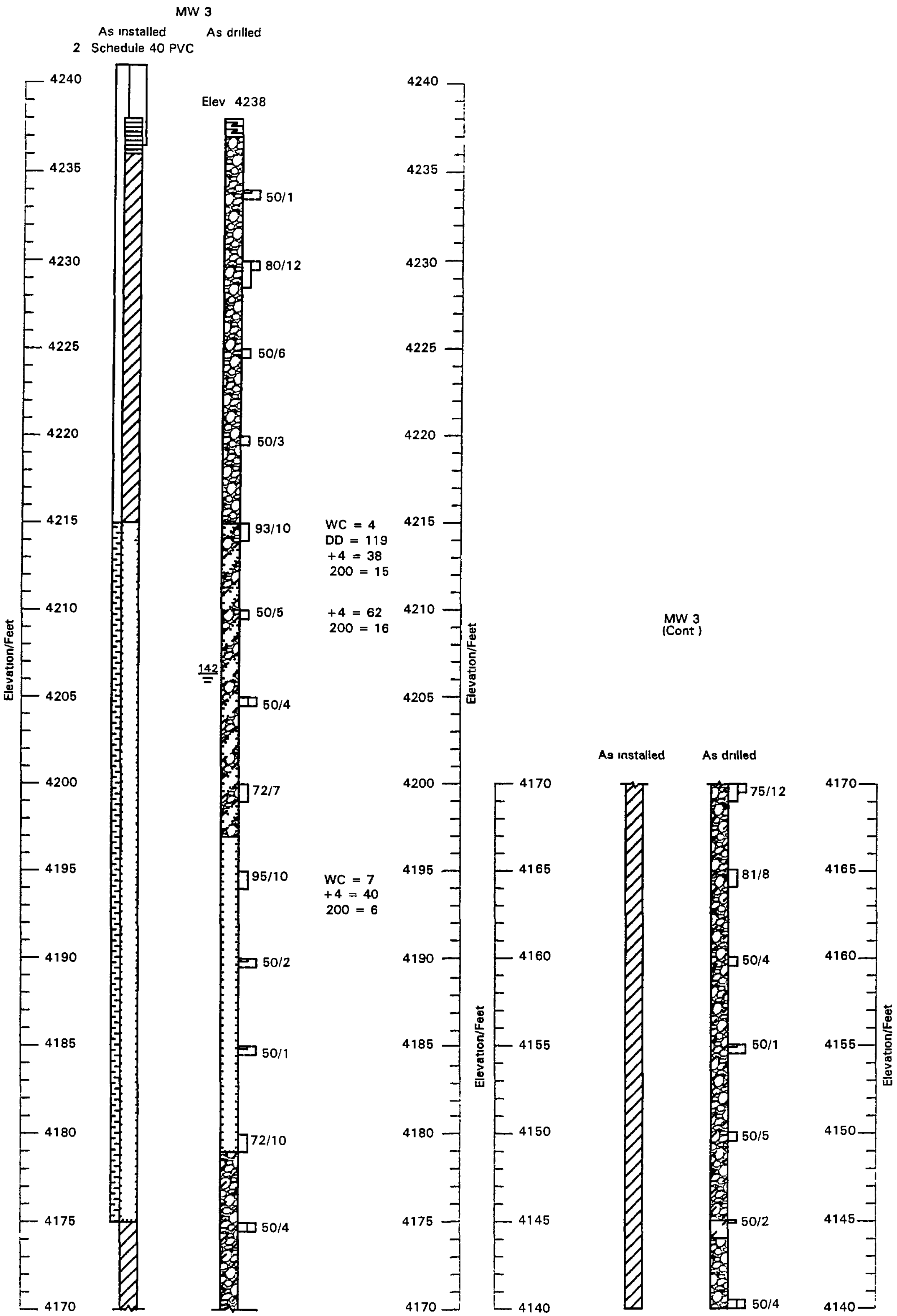
1020875	AGEC	Log of Monitor Well MW 1	Figure 3



Approximate Vertical Scale 1 = 8

See Figure 13 for Legend and Notes

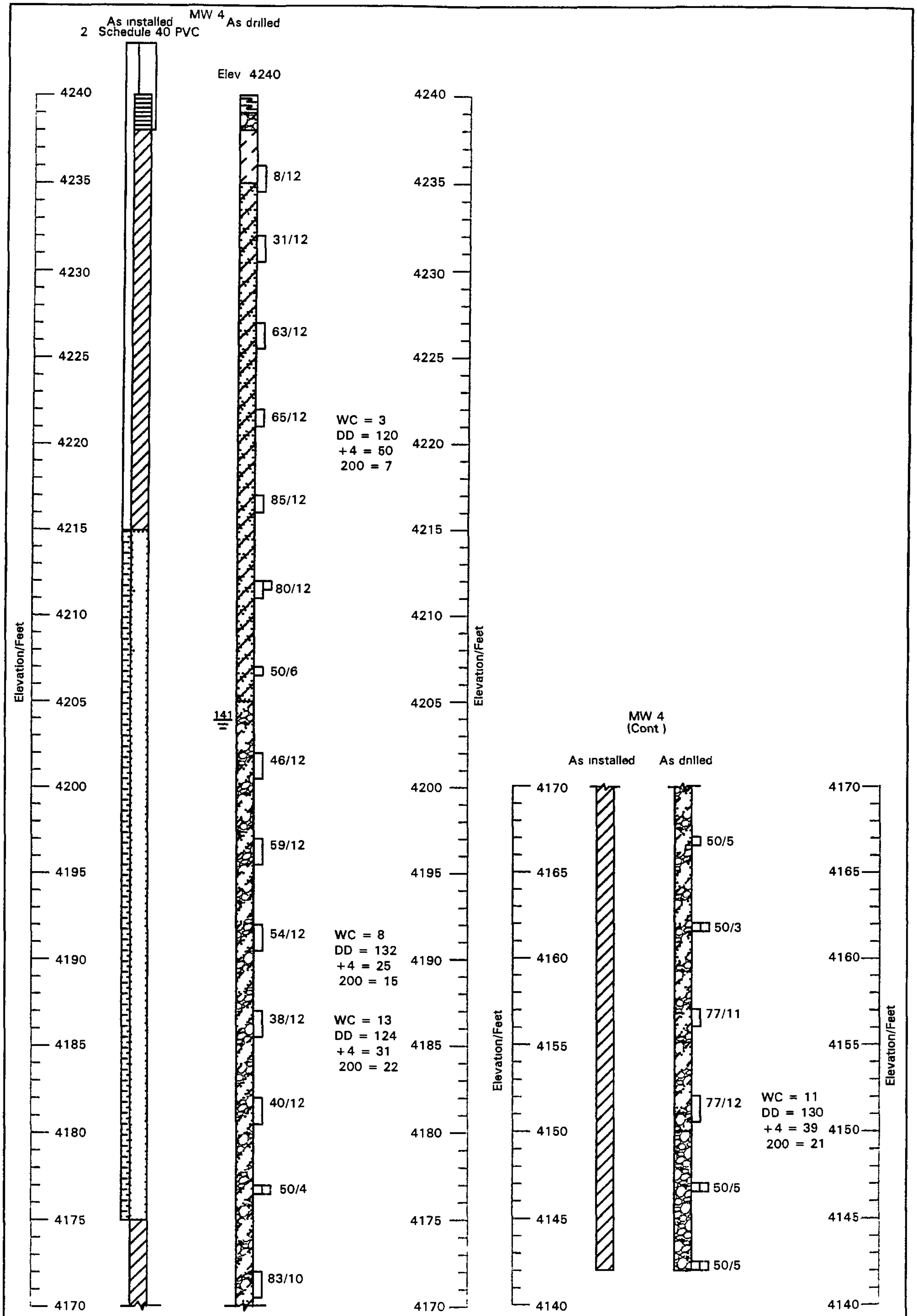
1020876	AGRA	Log of Monitor Well MW 2	Figure 4



Approximate Vertical Scale 1 = 8

See Figure 13 for Legend and Notes

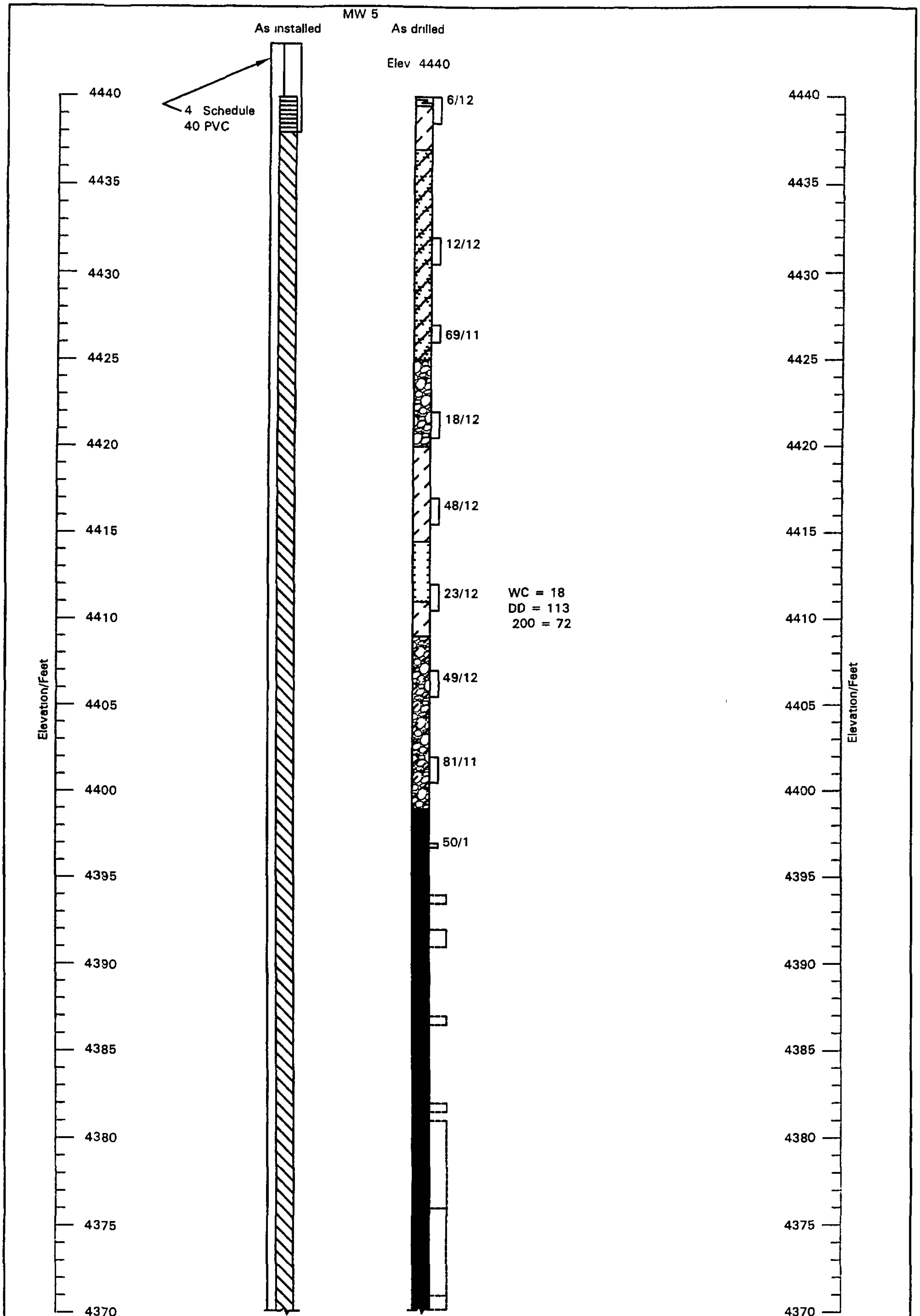
1020875	AGEC	Log of Monitor Well MW 3	Figure 5



Approximate Vertical Scale 1 = 8

See Figure 13 for Legend and Notes

1020875	AGEC	Log of Monitor Well MW 4	Figure 6



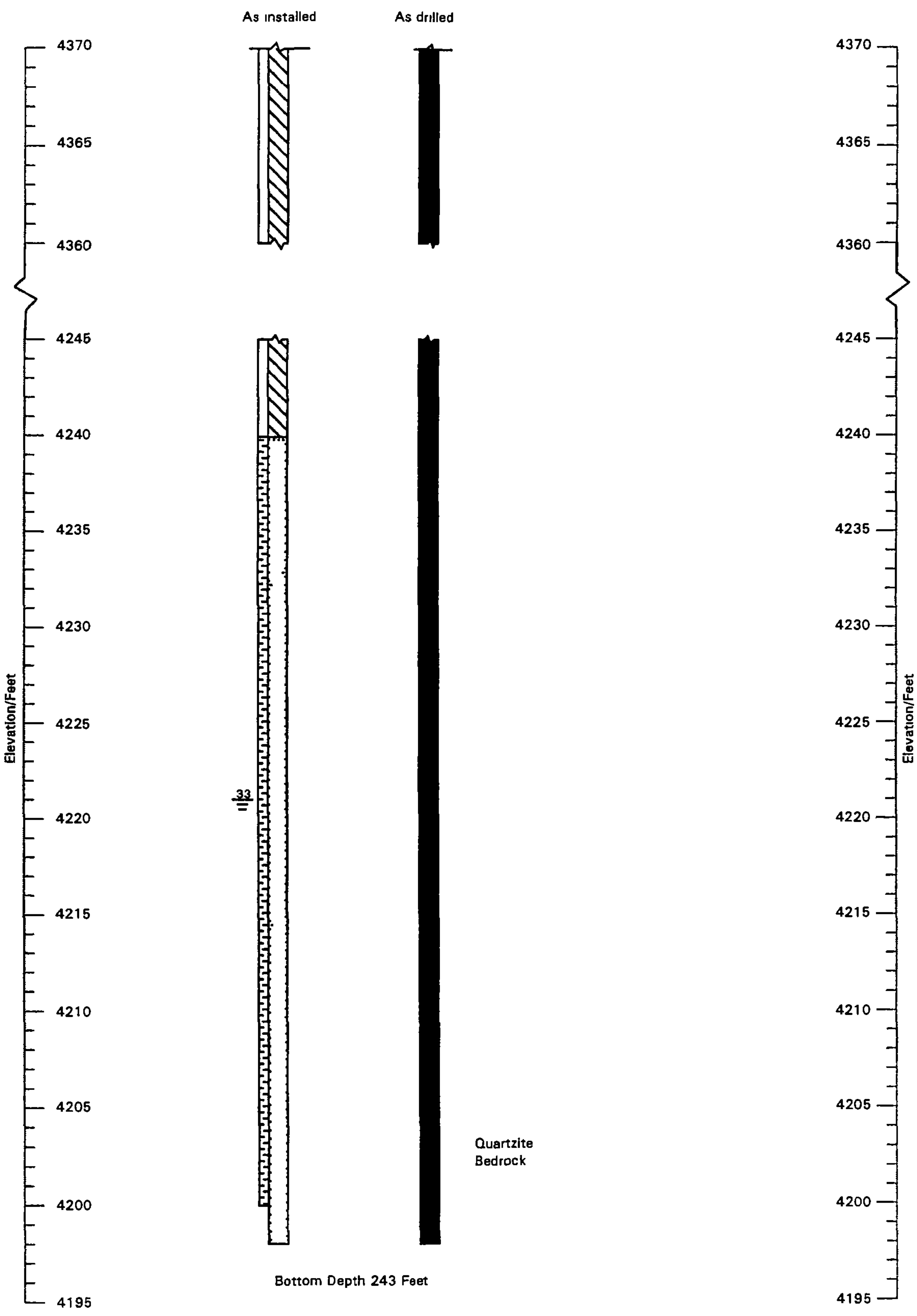
Approximate Vertical Scale 1 = 8

Continued on next figure

See Figure 13 for Legend and Notes

1020875	Log of Monitor Well MW 5	Figure 7

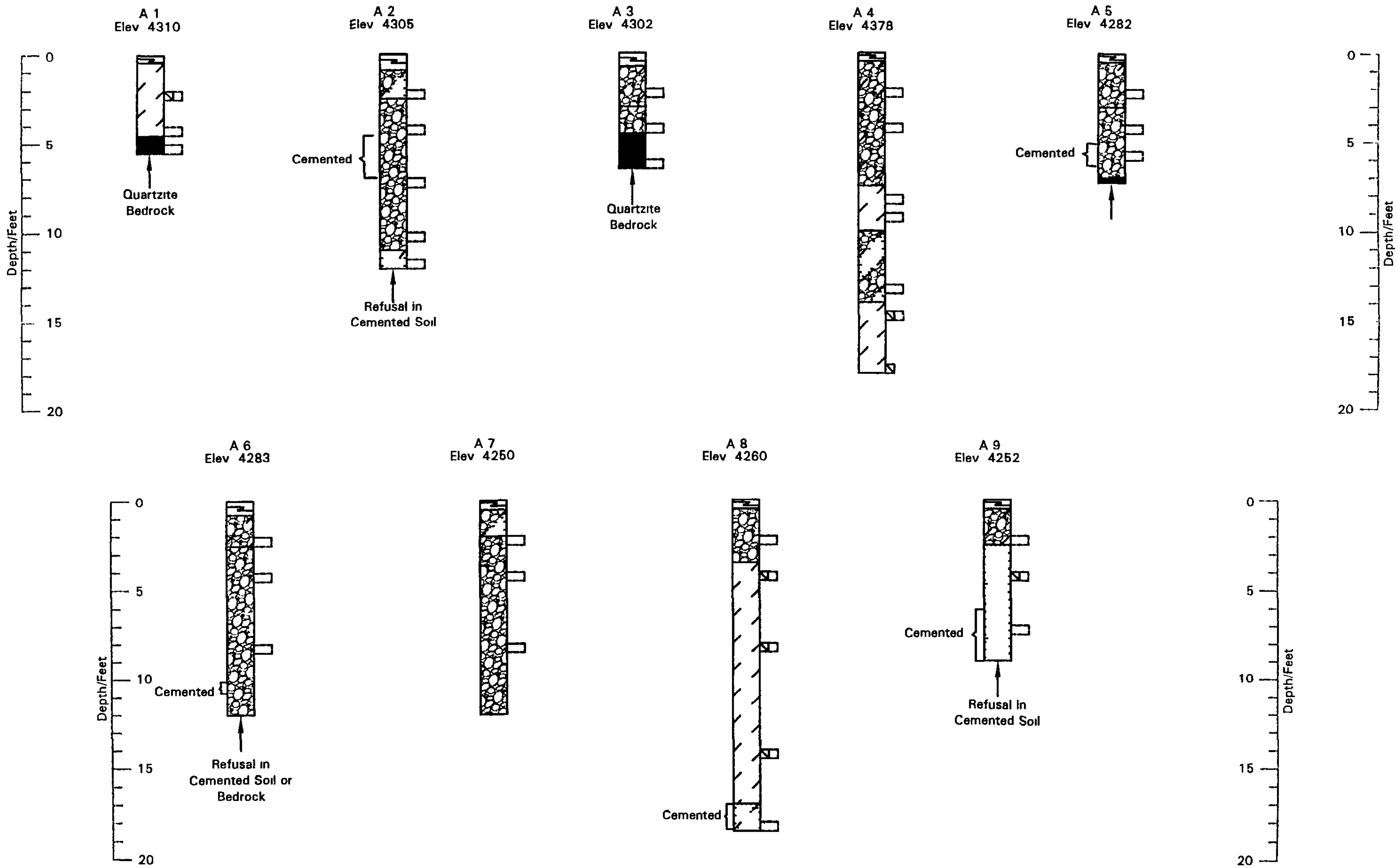
MW 5 (Continued)



Approximate Vertical Scale 1 = 8

See Figure 13 for Legend and Notes

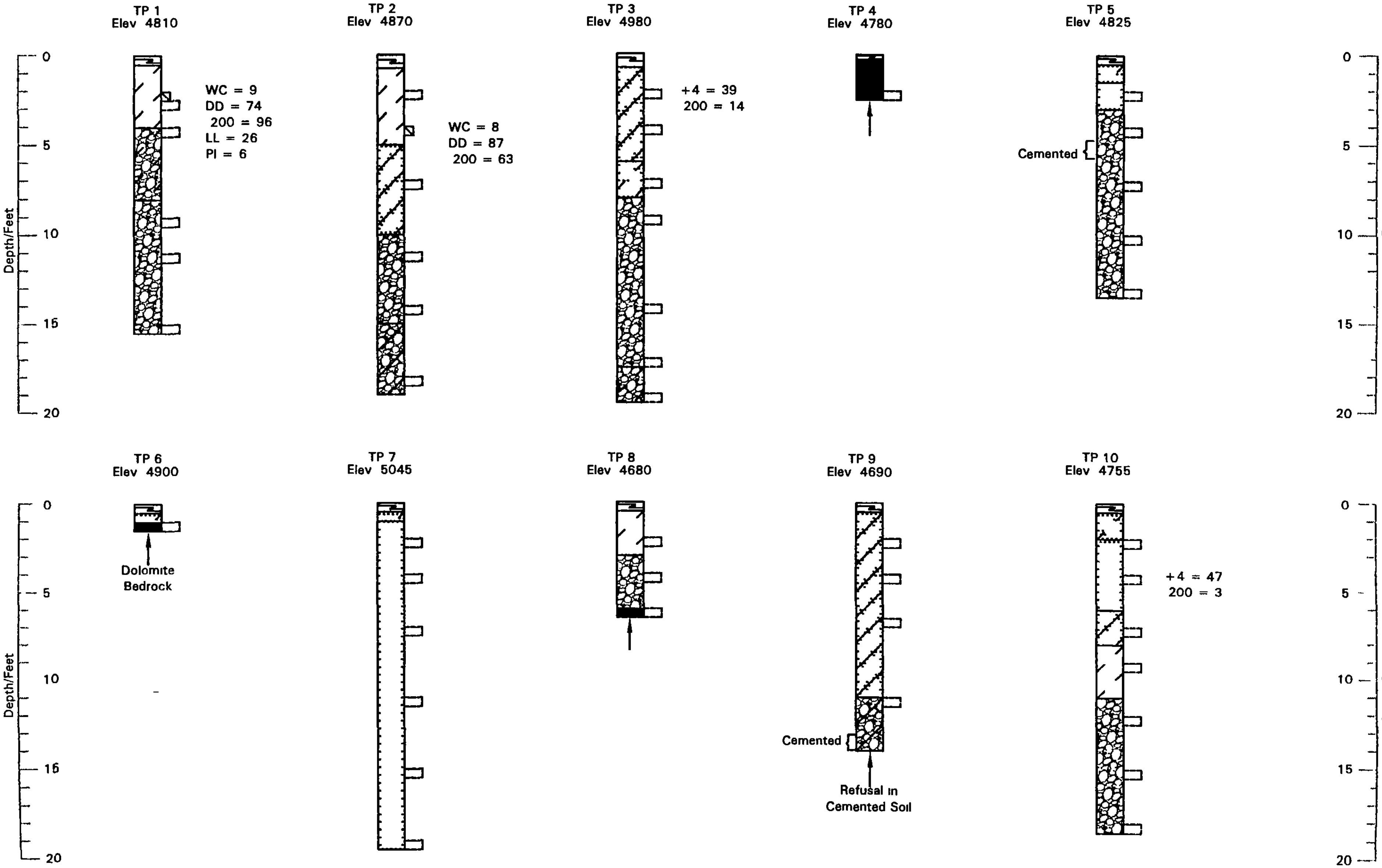
1020875	AGEC	Log of Monitor Well MW 5	Figure 8



Approximate Vertical Scale 1 = 8

See Figure 13 for Legend and Notes

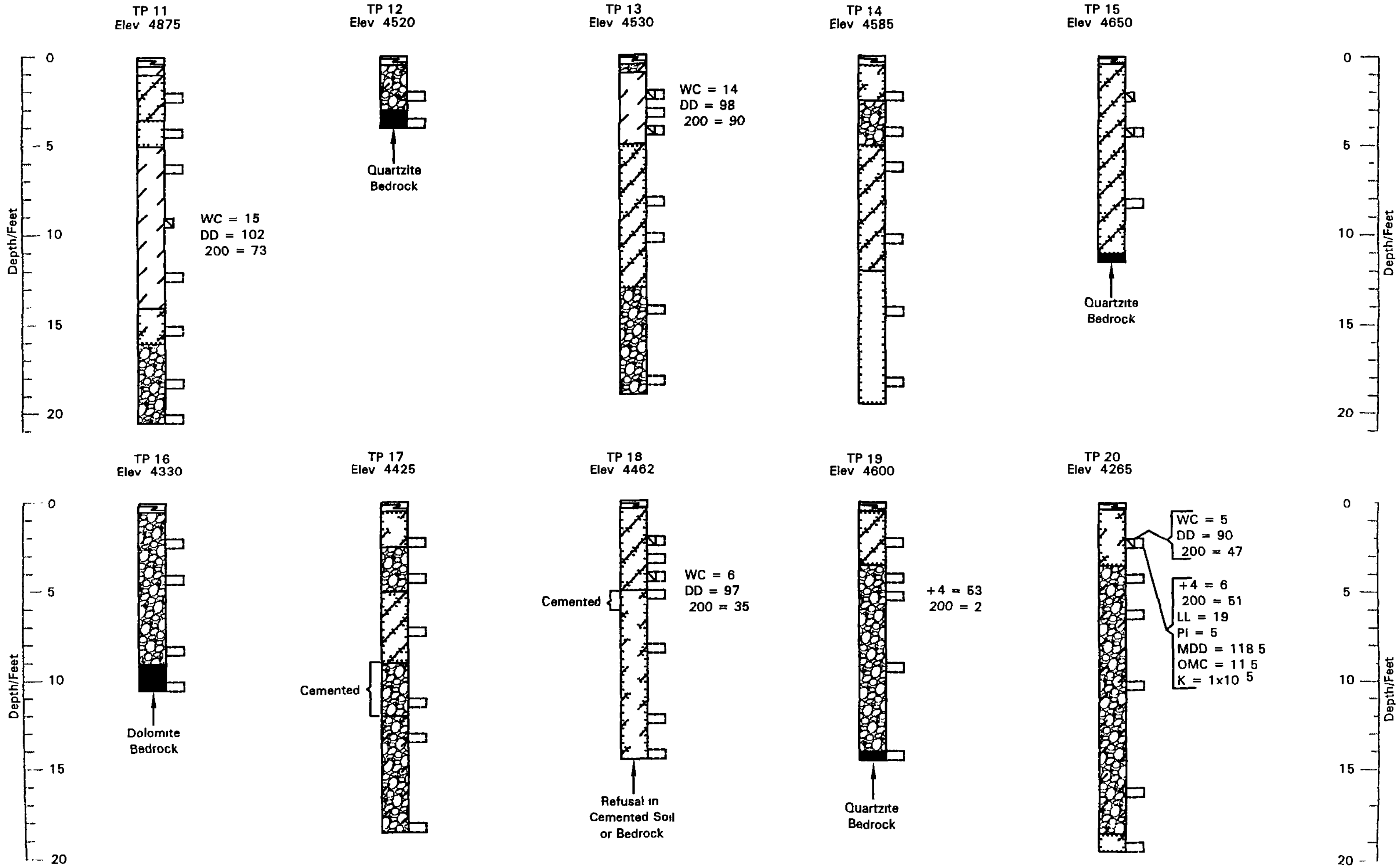
1020875	AGEC	Logs of Test Pits	Figure 9



Approximate Vertical Scale 1 = 8

See Figure 13 for Legend and Notes

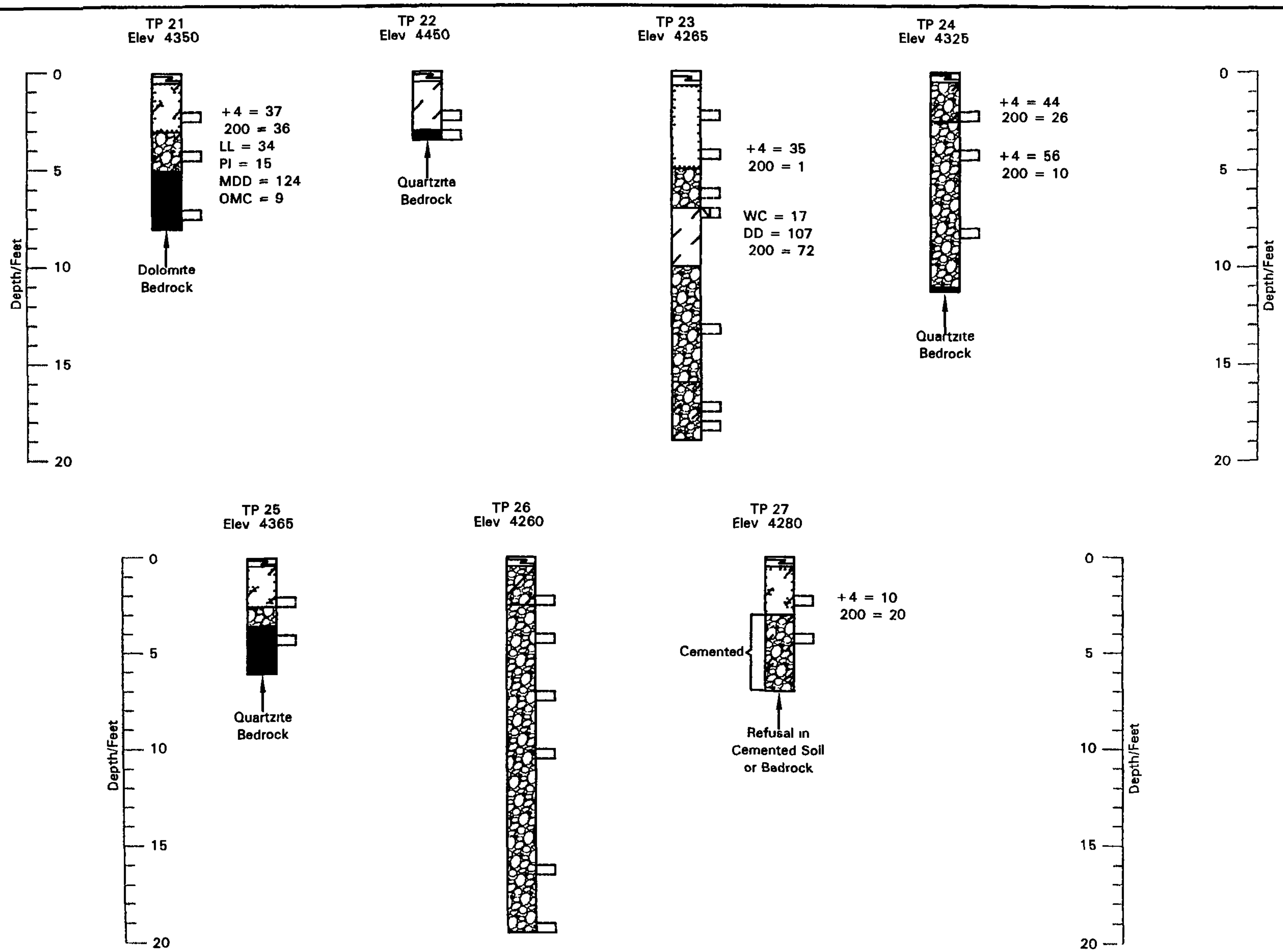
1020875	AGEC	Logs of Test Pits	Figure 10



Approximate Vertical Scale 1 = 8

See Figure 13 for Legend and Notes

1020875	AGEC	Logs of Test Pits	Figure 11



Approximate Vertical Scale 1 = 8

See Figure 13 for Legend and Notes

1020875	AGEC	Logs of Test Pits	Figure 12

Legend of Boring and Test Pit Logs

Topsoil silty and clayey sand and gravel to lean clay cobbles and occasional boulders slightly moist brown roots

Lean Clay (CL) small to moderate amount of gravel porous in Test Pits TP 1 TP 2 and A 1 cobbles and occasional boulders up to 3 feet in size stiff to very stiff slightly moist wet at depth in borings brown to reddish brown to grayish brown

Clayey Sand with Gravel (SC) clayey gravel layers cobbles and occasional boulders up to 1 / feet in size medium dense to dense slightly moist to moist brown

Silty Sand with Gravel (SM) clayey layers and gravel layers occasional cemented layers cobbles and occasional boulders medium dense to very dense slightly moist brown to reddish brown

Poorly Graded Sand with Gravel (SP) gravel layers cobbles and occasional boulders occasional cemented layers medium dense to very dense slightly moist to moist wet at depth in the borings brown to grayish brown to reddish brown

Clayey Gravel with Sand and Clayey Sand with Gravel (GC/SC) Interlayered cobbles and occasional boulders occasional clay layers dense to very dense slightly moist to moist wet at depth in the borings brown to gray

Clayey Gravel with Sand (GC) clayey sand layers occasional clay layers cobbles and boulders up to approximately 2 feet in size occasional cemented layers medium dense to very dense slightly moist to moist wet at depth in the borings brown to gray

Silty Gravel with Sand (GM) silty send layers cobbles up to approximately 1 foot in size occasional cemented layers dense to very dense slightly moist brown

Poorly Graded Gravel with Sand (GP) sand layers occasional cemented layers cobbles and boulders up to approximately 2 feet in size medium dense to vary dense slightly moist to moist wet at depth in the borings brown to grayish brown

Bedrock quartzite and dolomite hard to very hard dry to wet grayish white to gray to purple

10/12 California Drive sample taken The symbol 10/12 Indicates that 10 blows from a 140 pound hammer falling 30 inches were required to drive the sampler 12 inches

Indicates relatively undisturbed hand drive sample taken

Indicates disturbed sample taken

Indicates practical refusal

0 Indicates the depth of subsurface water and the number of days after drilling the measurement was taken

NOTES

1 The borings for monitor wells MW 1 to MW 4 were drilled and installed on January 23 24 27 28 and 29 2003 with a 4 inch odex drilling system Monitor well MW 5 was drilled and installed May 14 to May 21 2003 with 8 inch Odex/Air Rotory methods The test pits were excavated on December 11 12 13 16 and 23 2002 with a track excavator

2 Locations of the borings and test pits were measured approximately by a hand held GPS

3 Elevations of the borings and test pits were estimated based on interplation between contours shwon on Figure 2

4 The boring and test pit locations and elevations should be considered accurate only to the degree implied by the method used

5 The lines between the materials shown on the boring and test pit logs represent the approximate boundanes between material types and the transitions may be gradual

6 No free water was encountered in the test pits at the time of excavating Water level readings shown on the monitor well logs were made at the time and under the conditions indicated Fluctuation in the water level will occur with time

7 WC = Water Content (%)
DD = Dry Density (pcf)
+4 = Percent Retained on No 4 Sieve
200 = Percent Passing No 200 Sieve
LL = Liquid Limit (%)
PI = Plasticity Index (%)
MDD = Maximum Dry Density determined by ASTM D 678 (pcf)
OMC = Optimum Moisture Content determined by ASTM D 678 (%)
K = Permeability (cm/sec)

LEGEND OF WELL INSTALLATION

Concrete

Bentonite Seal (3/8 chips)

Bentonite Grout

Sand pack around well screen 10 20 Silica Sand

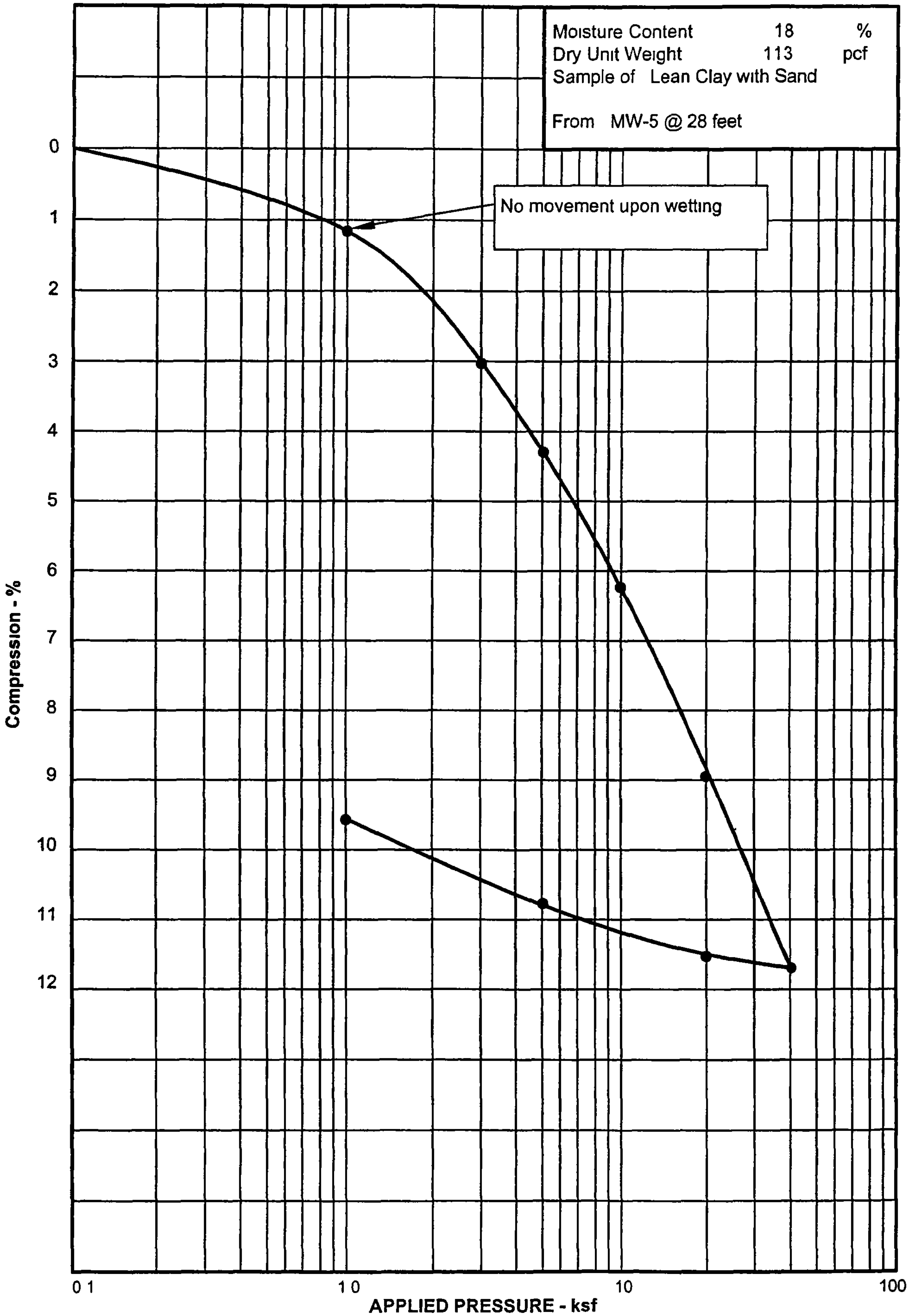
Indicates Schedule 40 PVC flush threaded pipe installed

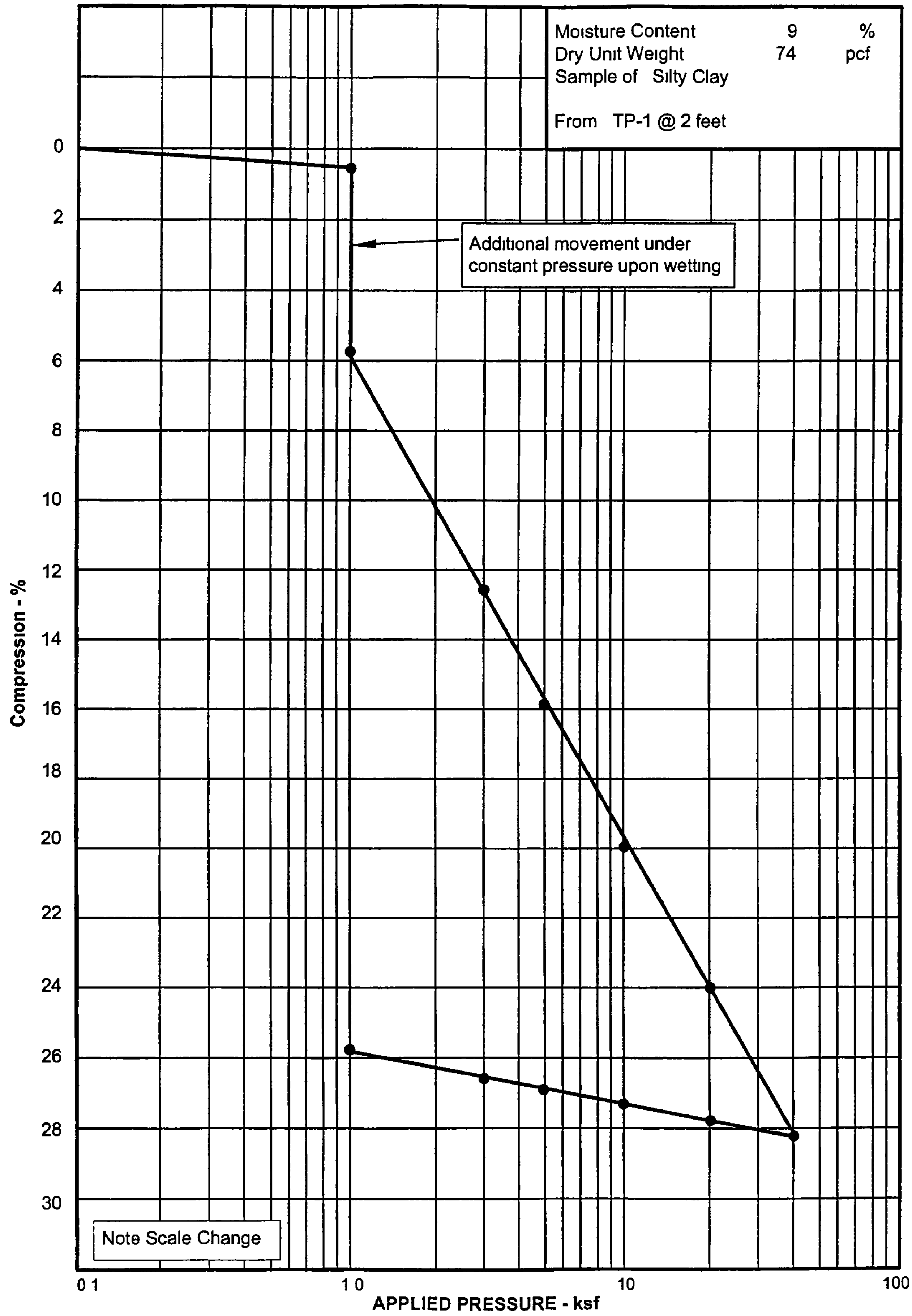
Indicates machine slotted schedule 40 PVC flush treaded pipe with 0 01 inch openings installed

Indicates steel protective casing installed The casings are 4 inch diameter for MW 1 through MW 4 The casing is 8 inch square for MW 5

1020875	AGEC	Legend and Notes of Exploratory Borings Test Pits and Monitor Wells	Figure 13

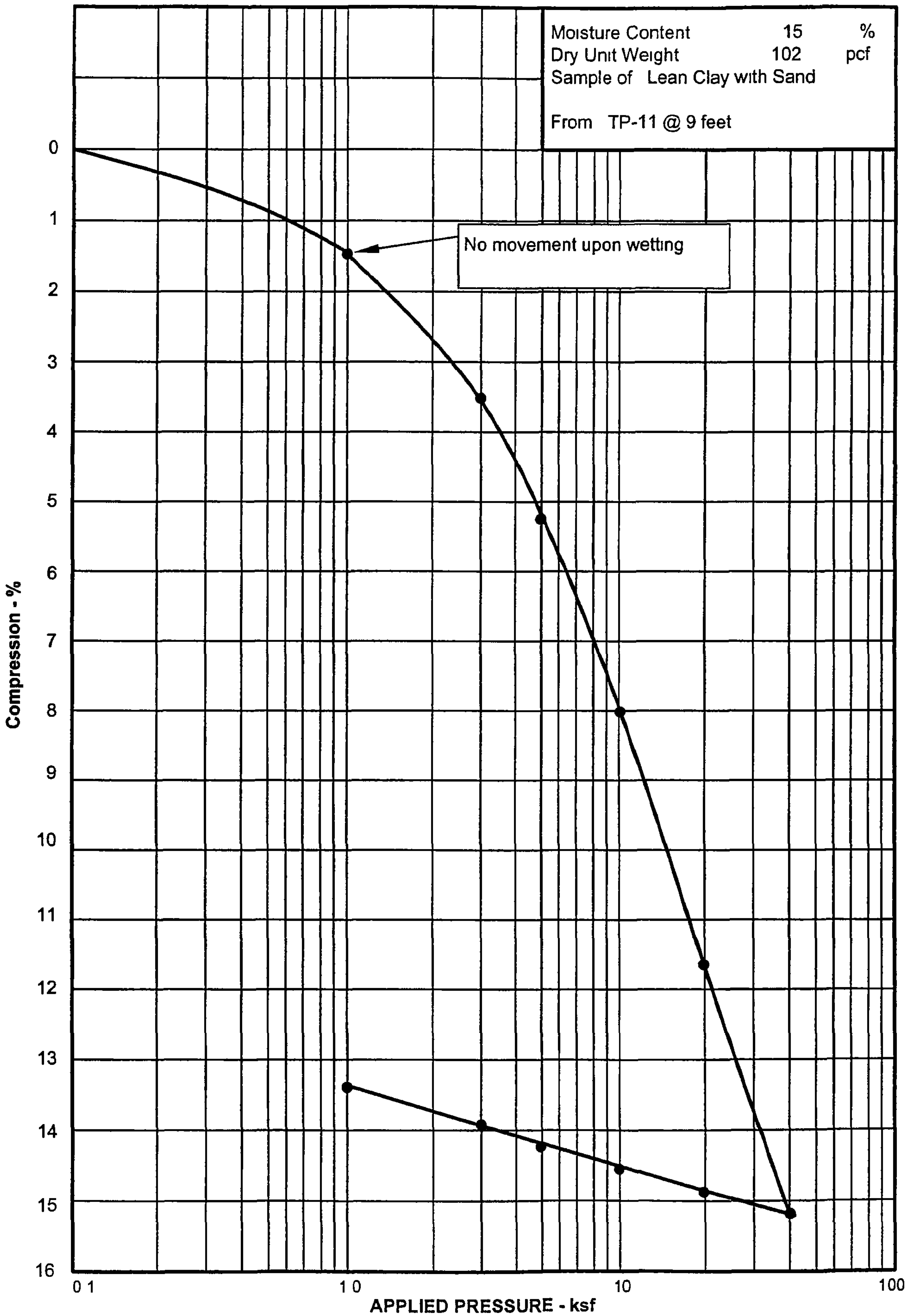
Applied Geotechnical Engineering Consultants, Inc





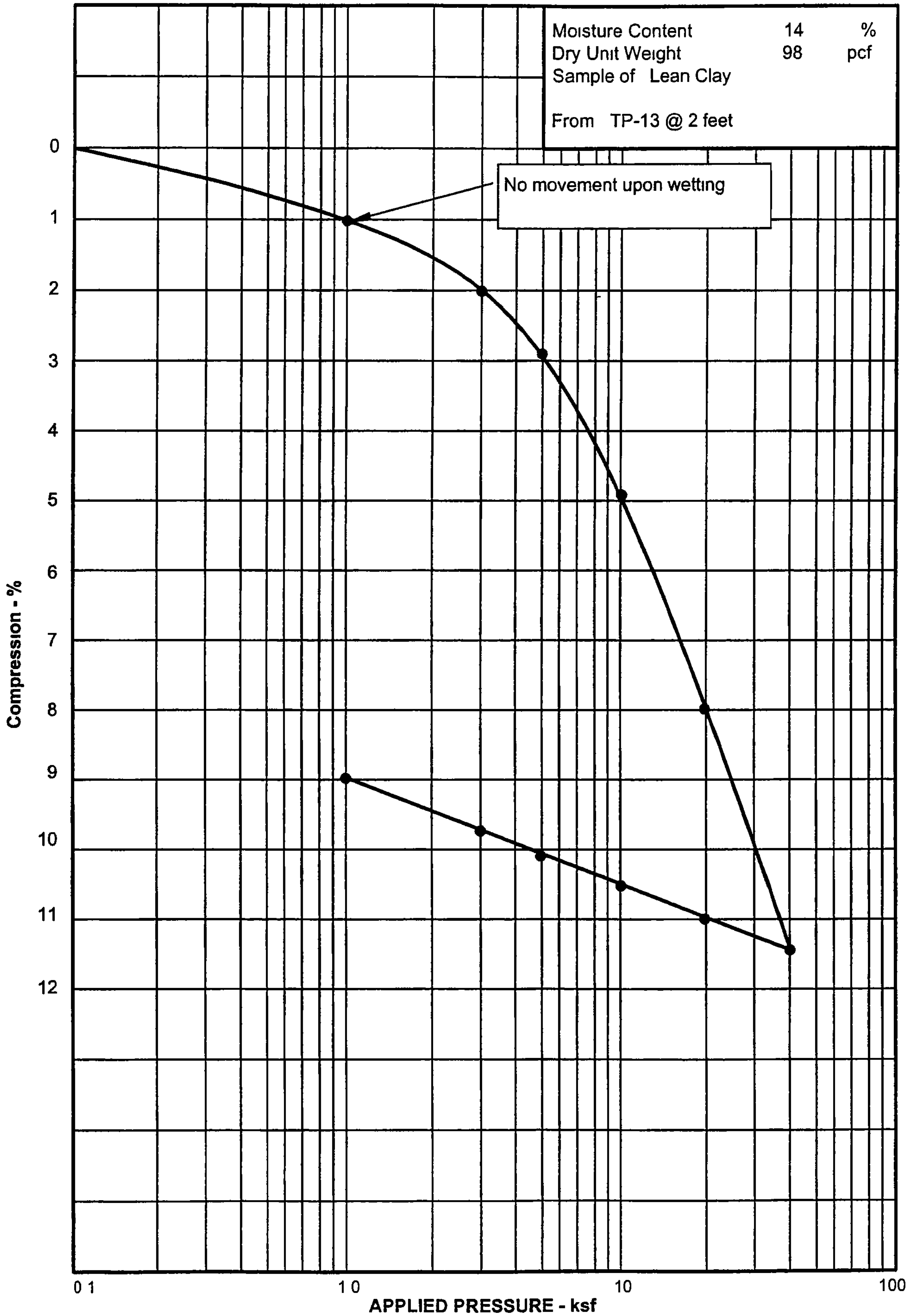
Moisture Content 9 %
Dry Unit Weight 74 pcf
Sample of Silty Clay
From TP-1 @ 2 feet
Additional movement under constant pressure upon wetting
Compression - %
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
Note Scale Change
0 1
1 0
10
100
APPLIED PRESSURE - ksf

Applied Geotechnical Engineering Consultants, Inc



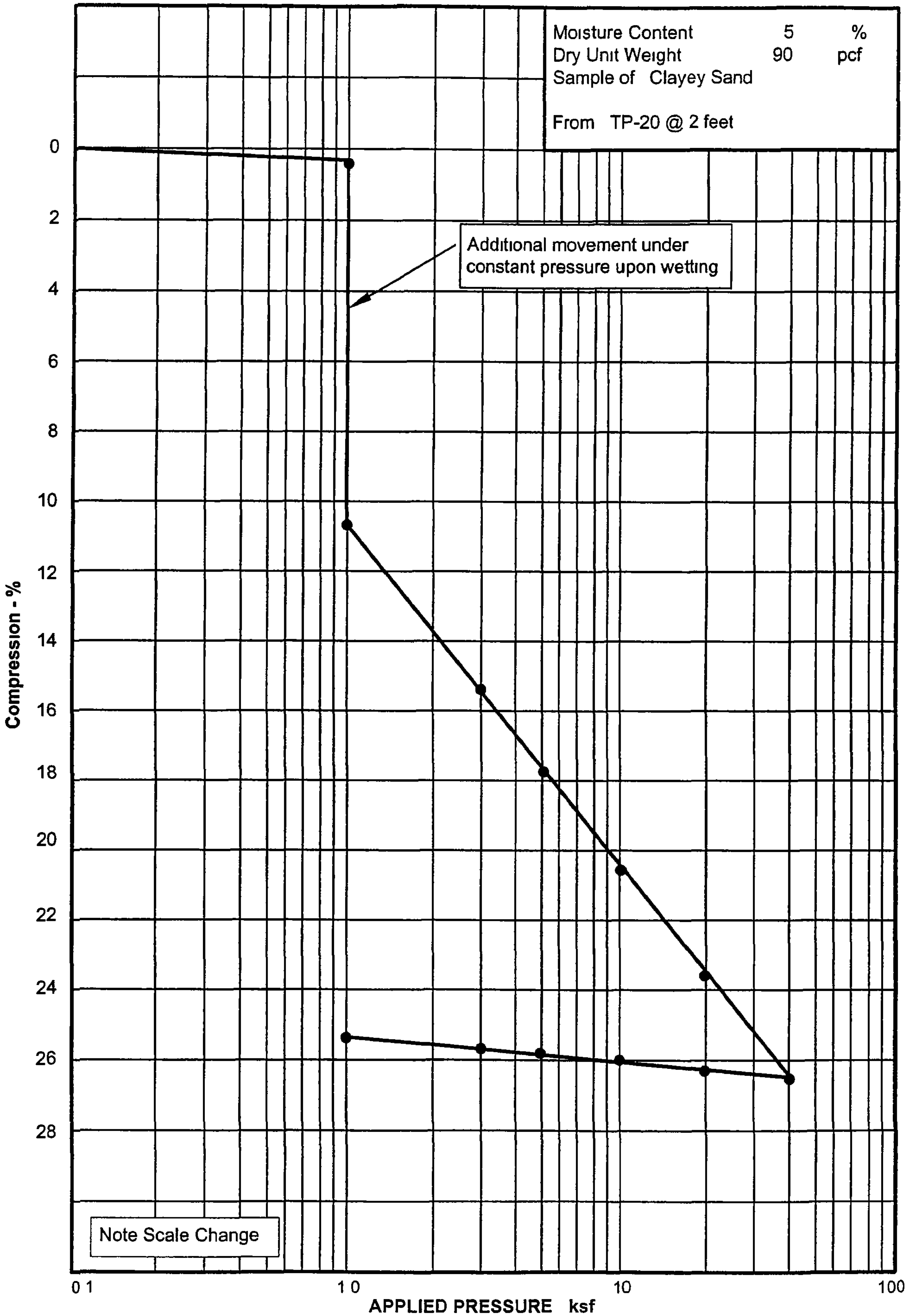
1020875 **CONSOLIDATION TEST RESULTS** **Figure 16**

Applied Geotechnical Engineering Consultants, Inc

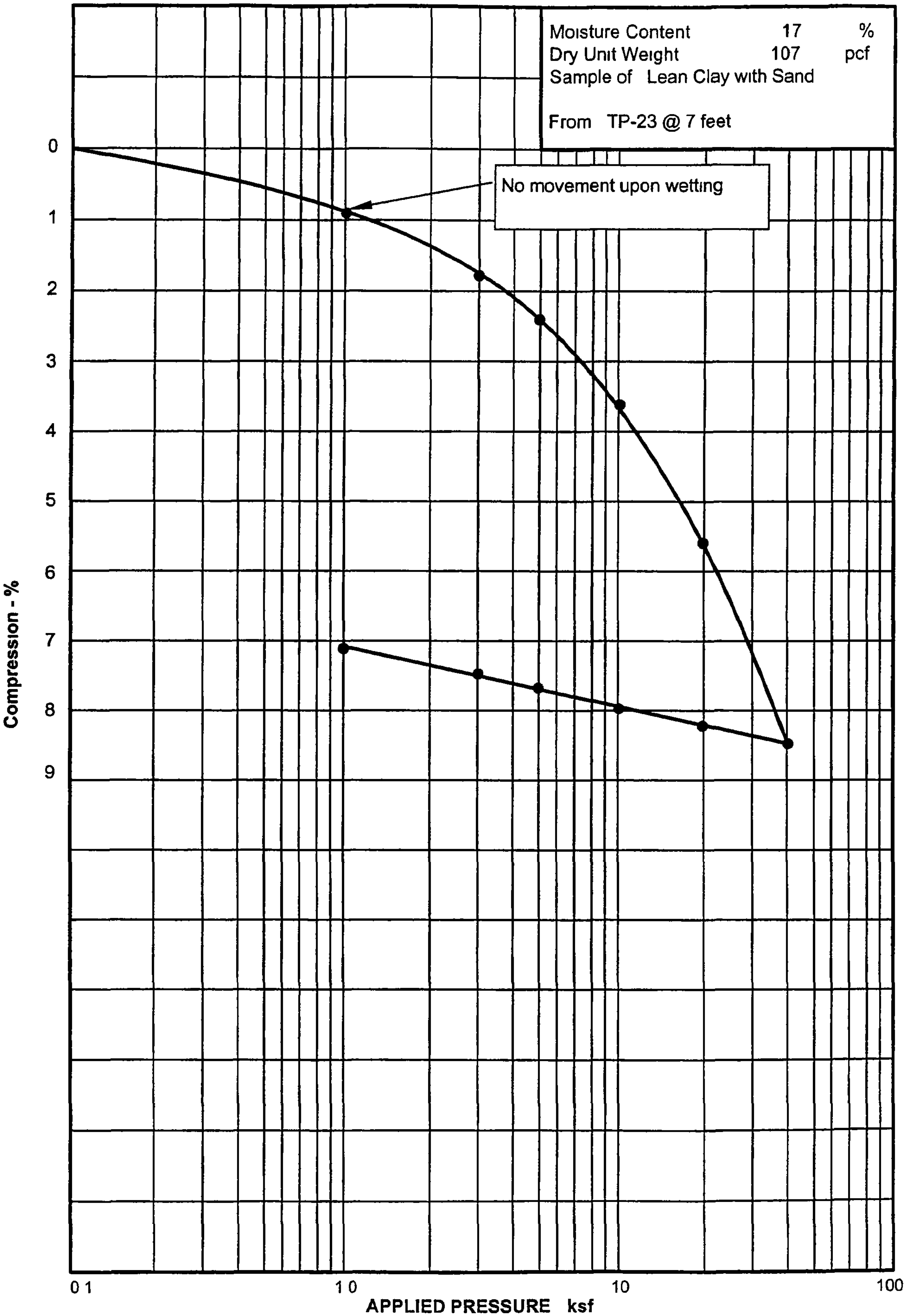


1020875 CONSOLIDATION TEST RESULTS Figure 17

Applied Geotechnical Engineering Consultants, Inc

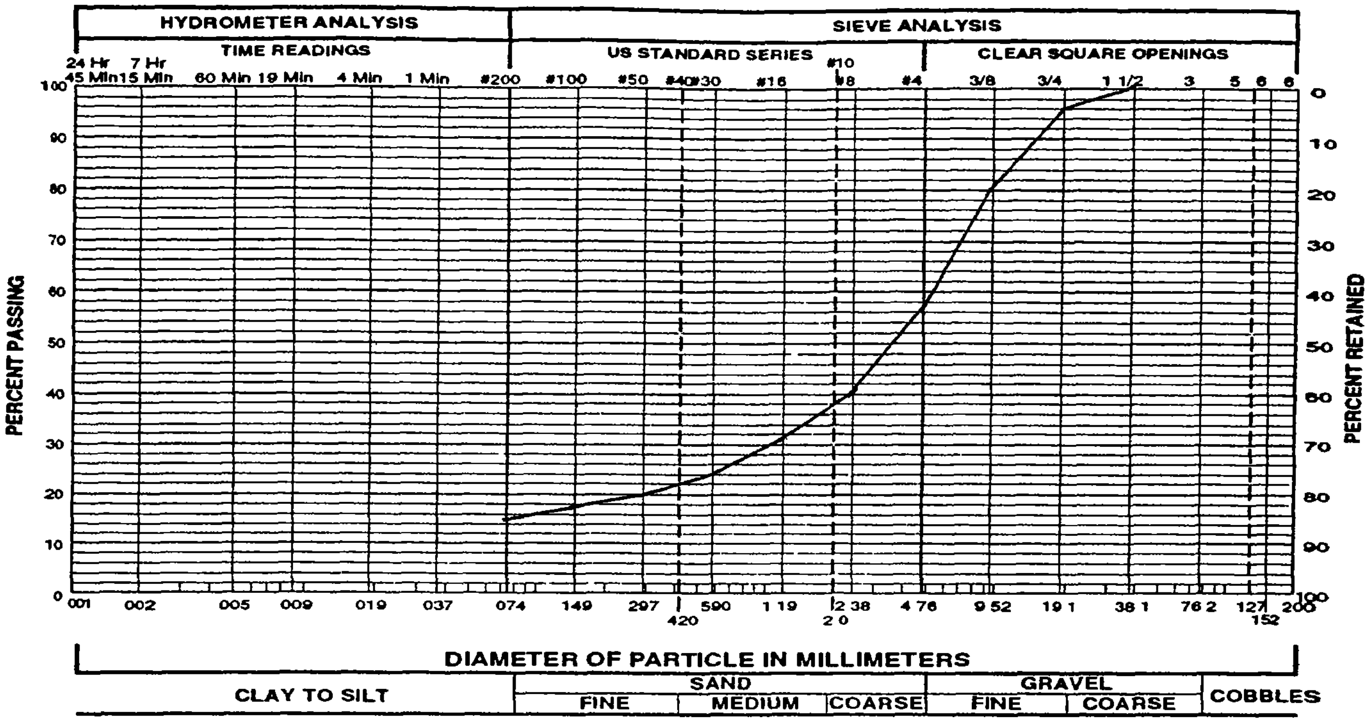


1020875 **CONSOLIDATION TEST RESULTS** Figure 18



1020875 CONSOLIDATION TEST RESULTS Figure 19

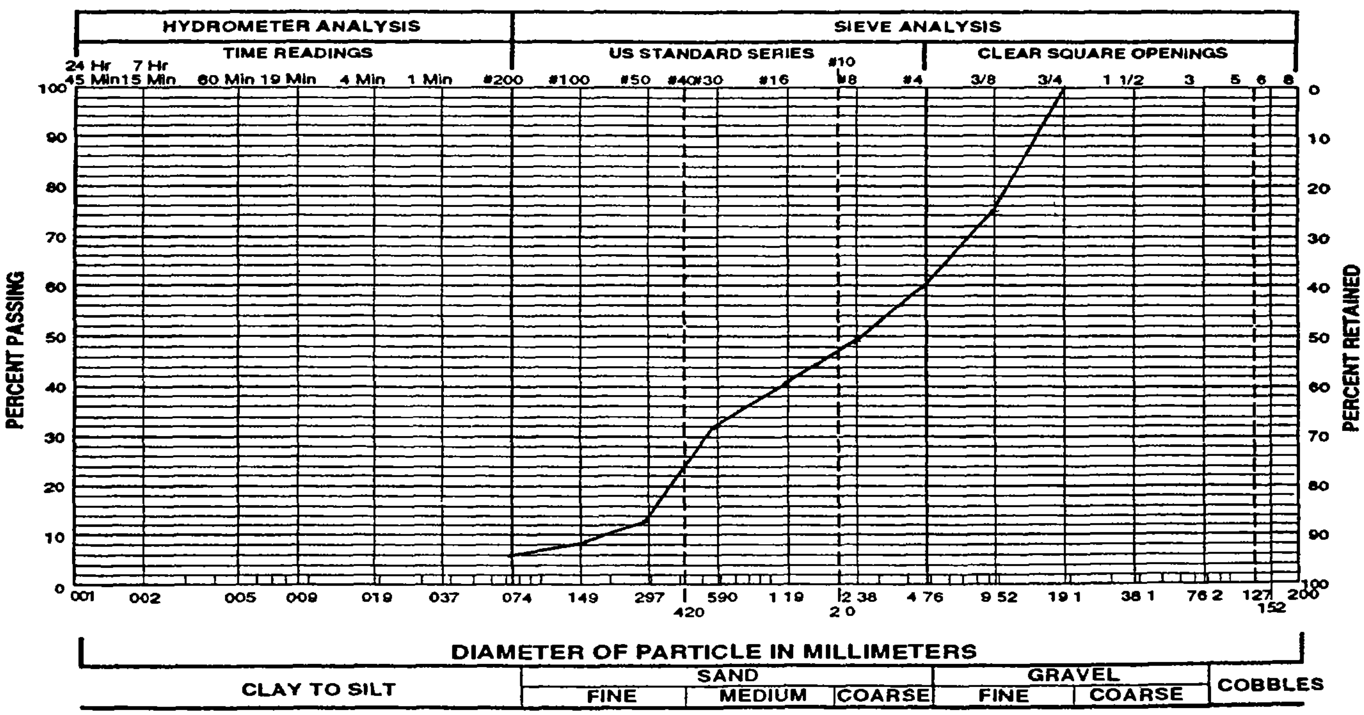
Applied Geotechnical Engineering Consultants, Inc



Gravel 43 % Sand 42 % Silt and Clay 15 %

Liquid Limit ____ % Plasticity Index ____ %

Sample of Clayey Gravel with Sand From MW-1 @ 38'



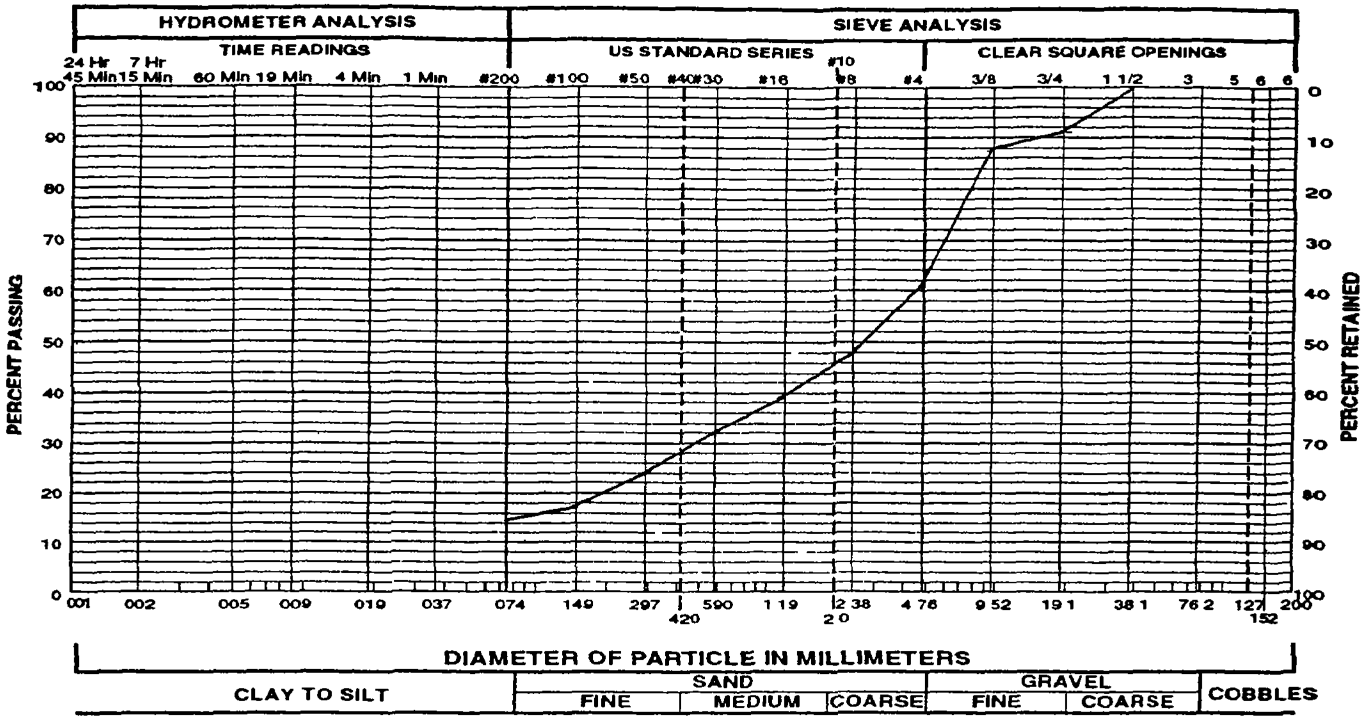
Gravel 40 % Sand 54 % Silt and Clay 6 %

Liquid Limit ____ % Plasticity Index ____ %

Sample of Poorly-graded Sand with Silt and Gravel From MW-3 @ 43'

Project No 1020875 **GRADATION TEST RESULTS** Figure 20

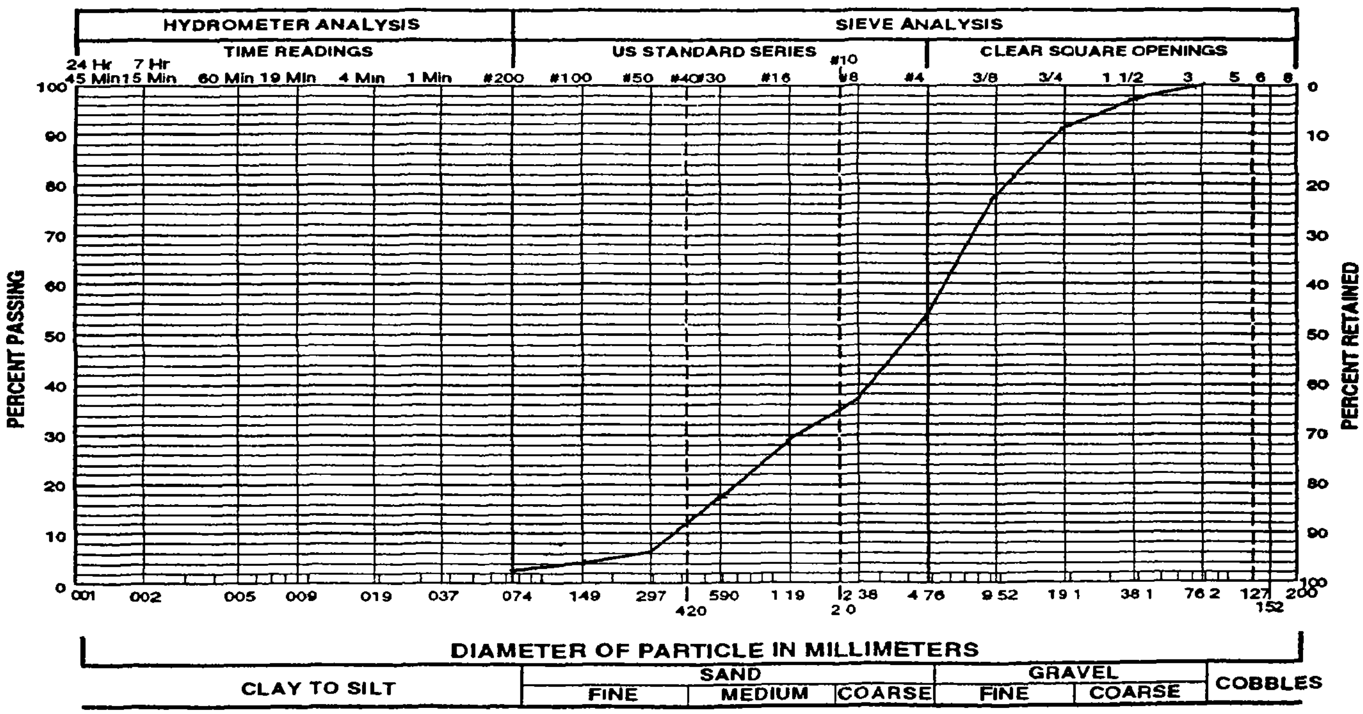
Applied Geotechnical Engineering Consultants, Inc



Gravel 39 % Sand 47 % Silt and Clay 14 %

Liquid Limit ______ % Plasticity Index ______ %

Sample of Silty Sand with Gravel From TP-3 @ 2'



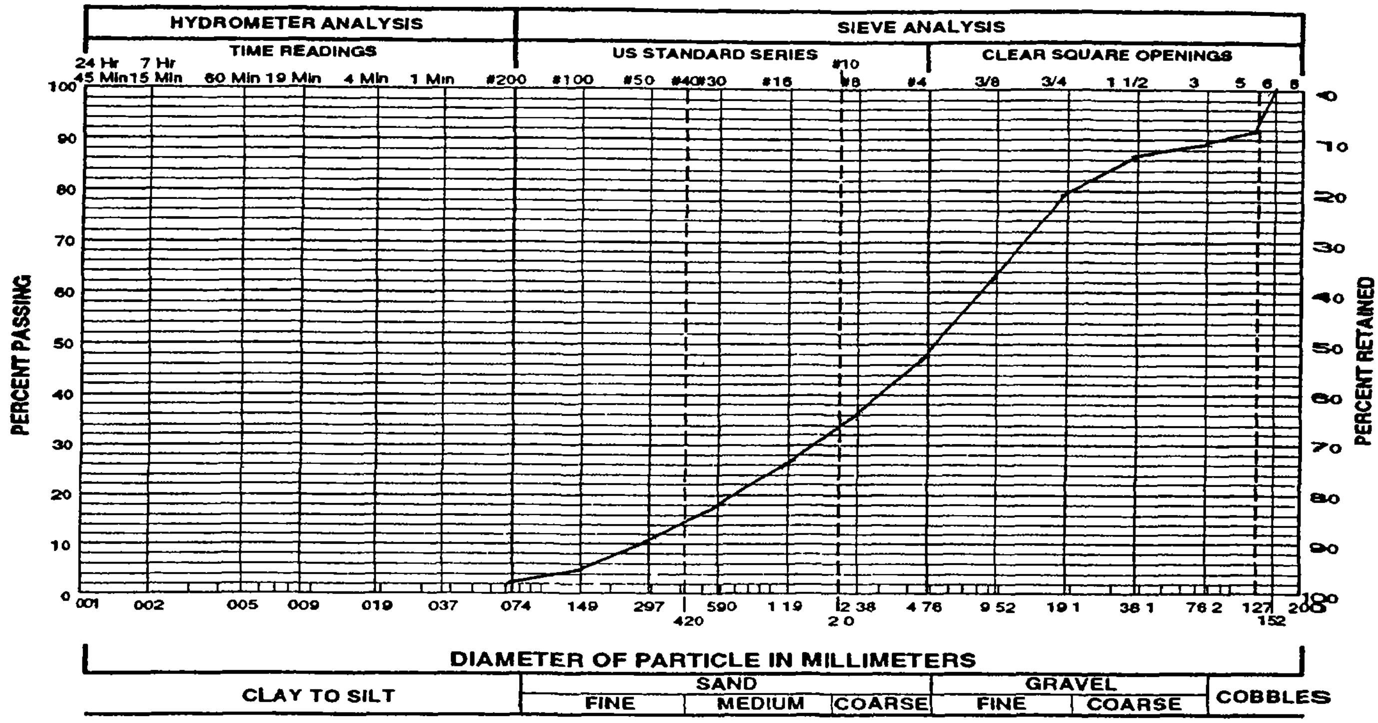
Gravel 47 % Sand 50 % Silt and Clay 3 %

Liquid Limit ______ % Plasticity Index ______ %

Sample of Poorly-graded Sand with Gravel From TP-10 @ 4'

Project No 1020875 **GRADATION TEST RESULTS** Figure 21

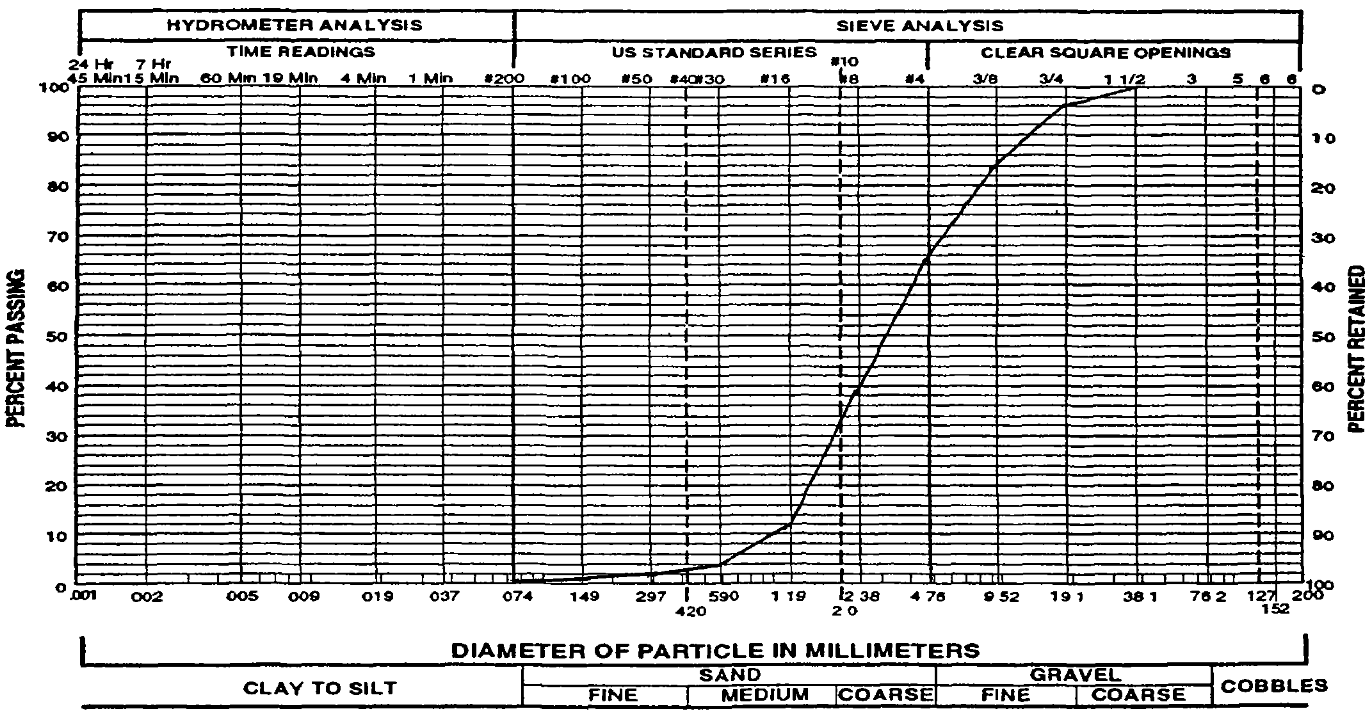
Applied Geotechnical Engineering Consultants, Inc



Gravel 53 % Sand 45 % Silt and Clay 2 %

Liquid Limit ______ % Plasticity Index ______ %

Sample of Poorly-graded Gravel with Sand From TP-19 @ 5'



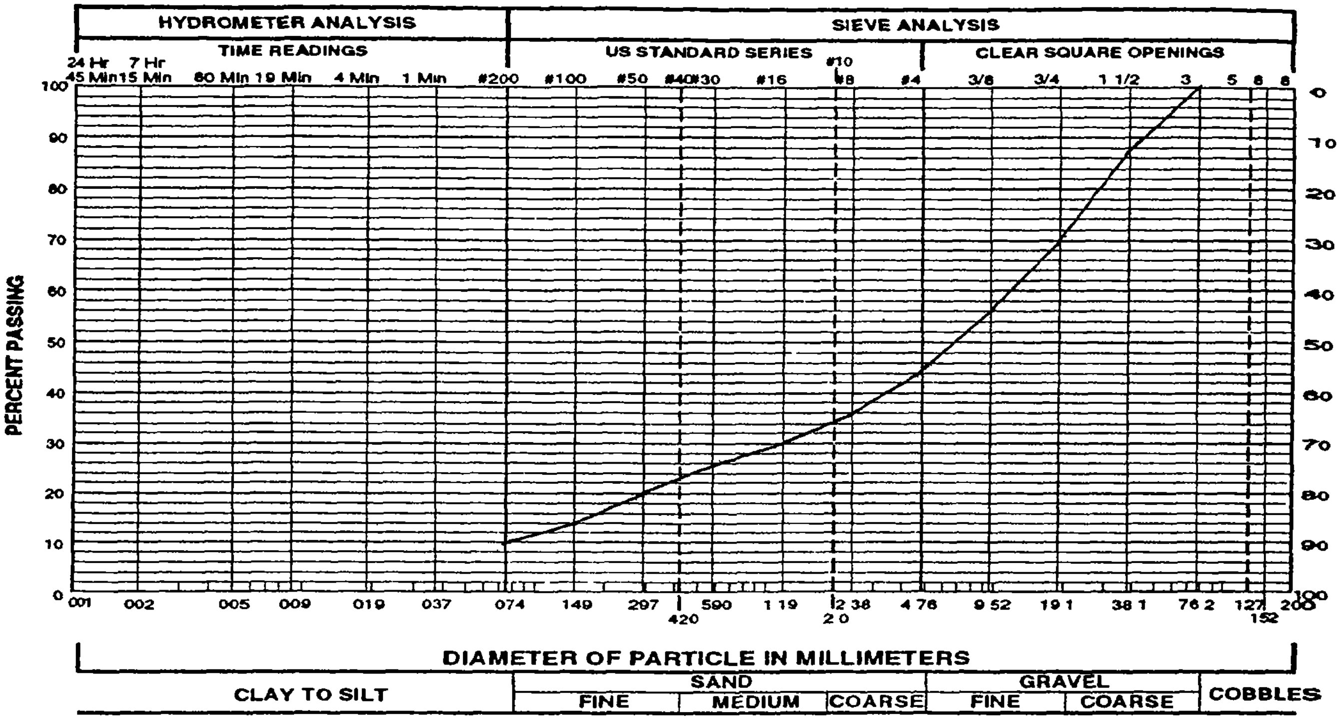
Gravel 35 % Sand 64 % Silt and Clay 1 %

Liquid Limit ______ % Plasticity Index ______ %

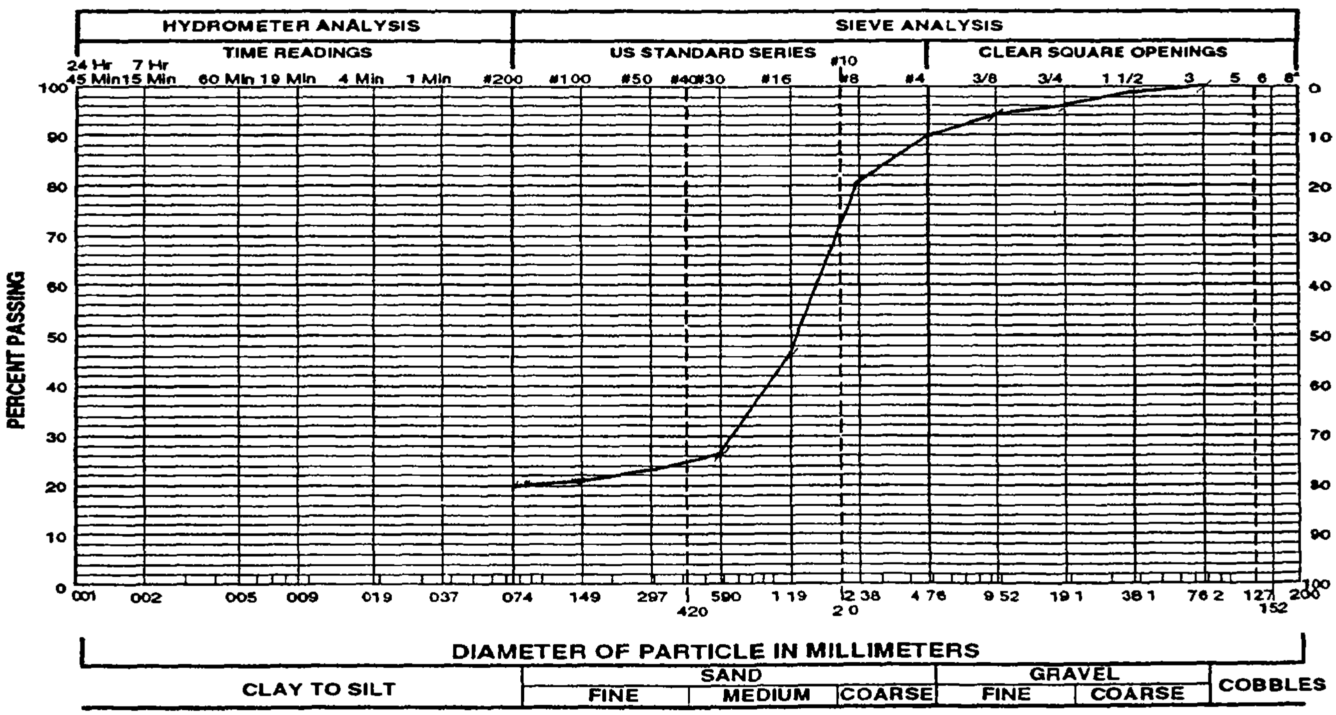
Sample of Poorly-graded Sand with Gravel From TP-23 @ 4'

Project No 1020875 **GRADATION TEST RESULTS** Figure 22

Applied Geotechnical Engineering Consultants, Inc



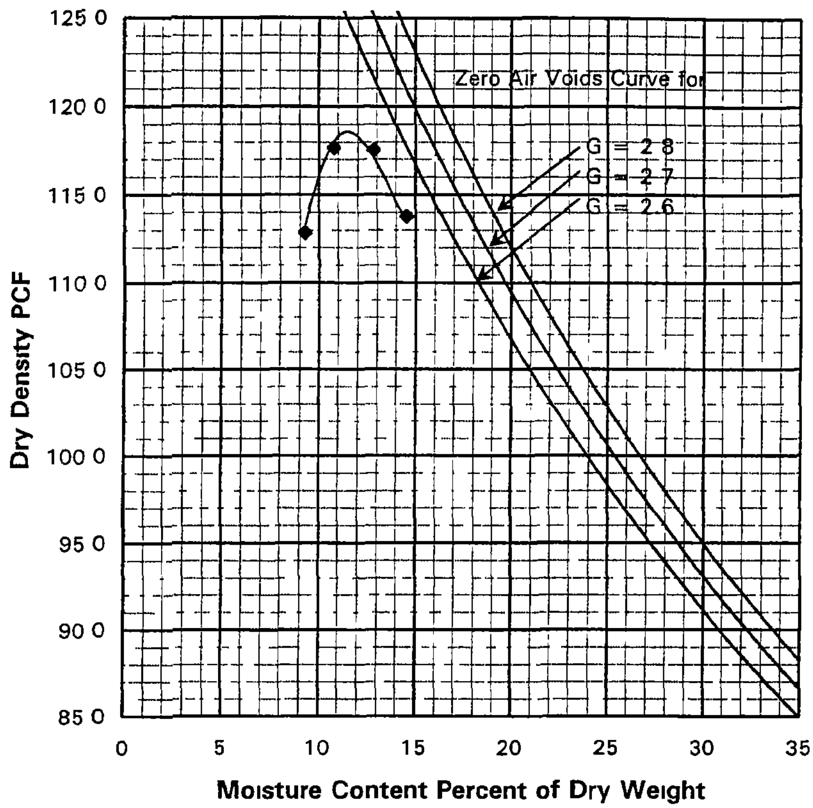
Gravel 56 % Sand 34 % Silt and Clay 10 %
Liquid Limit ______ % Plasticity Index ______ %
Sample of Well-graded Gravel with Silt and Sand From TP-24 @ 4'



Gravel 10 % Sand 70 % Silt and Clay 20 %
Liquid Limit ______ % Plasticity Index ______ %
Sample of Clayey Sand From TP-27 @ 2'

Project No 1020875 **GRADATION TEST RESULTS** Figure 23

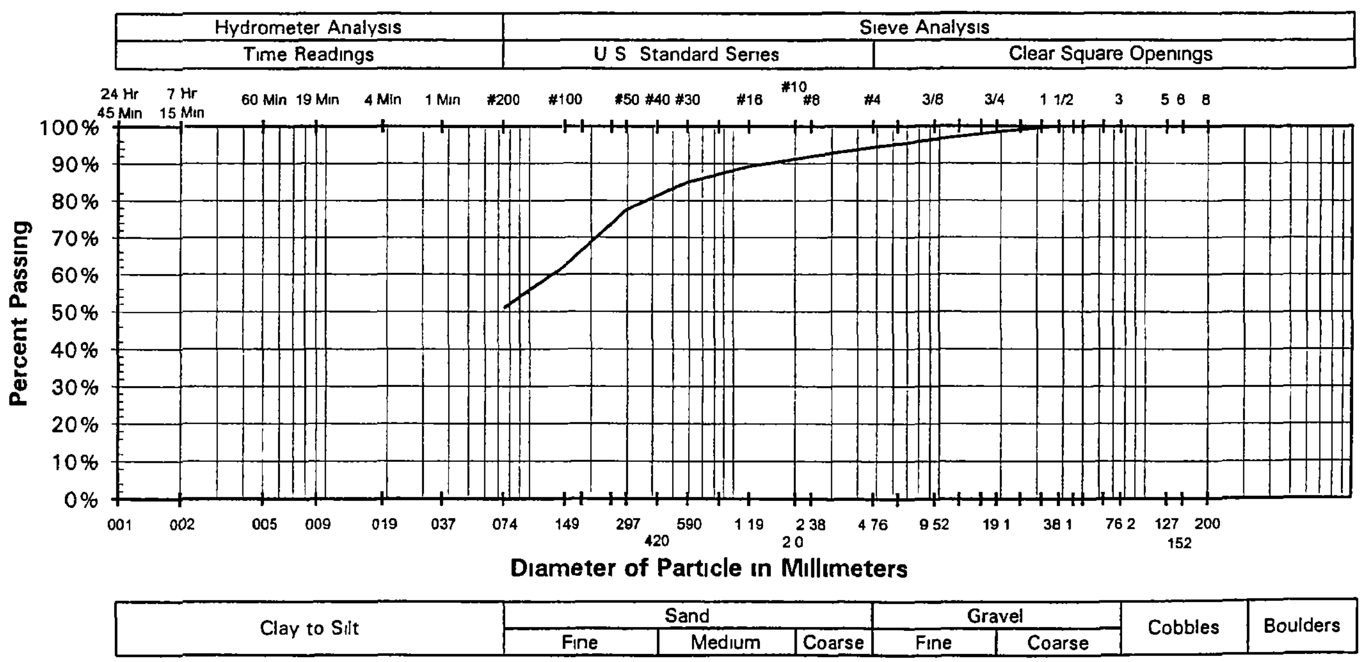
APPLIED GEOTECHNICAL ENGINEERING CONSULTANTS, INC



Project	Promontory Point
Sample Location	TP 20 @ 2
Maximum Dry Density	118 5 pcf
Optimum Moisture	11 5%
Atterberg Limits	
Liquid Limit	19%
Plasticity Index	5%
Gradation	
Gravel	6%
Sand	43%
Silt & Clay	51%

Test Procedure ASTM D 698 A

Sample Description Sandy Silty Clay (CL ML)

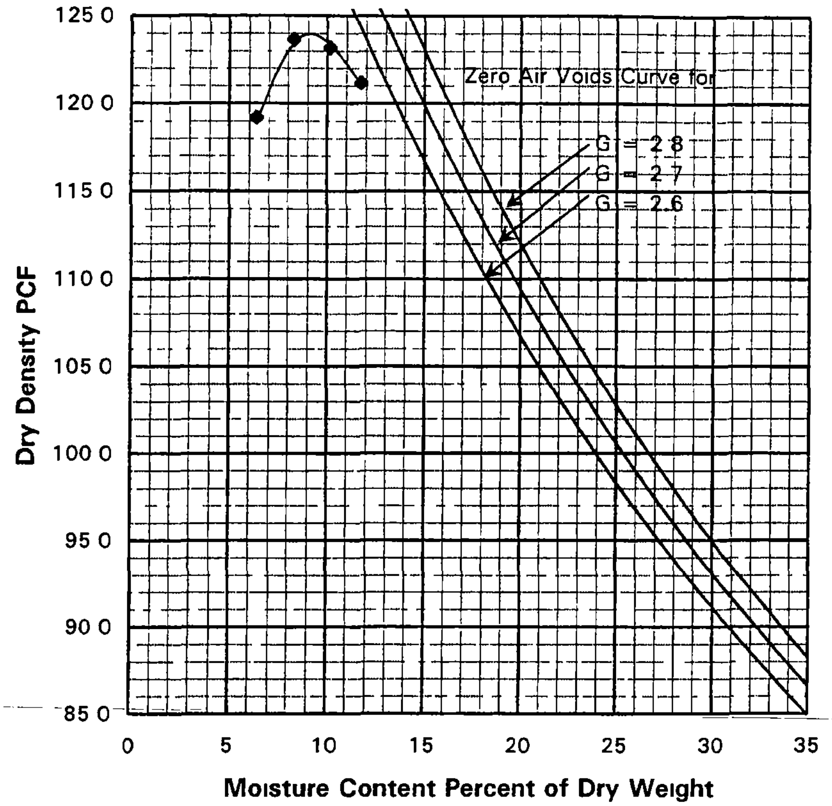


GRADATION & MOISTURE-DENSITY RELATIONSHIP

Project No 1020875

Figure 24

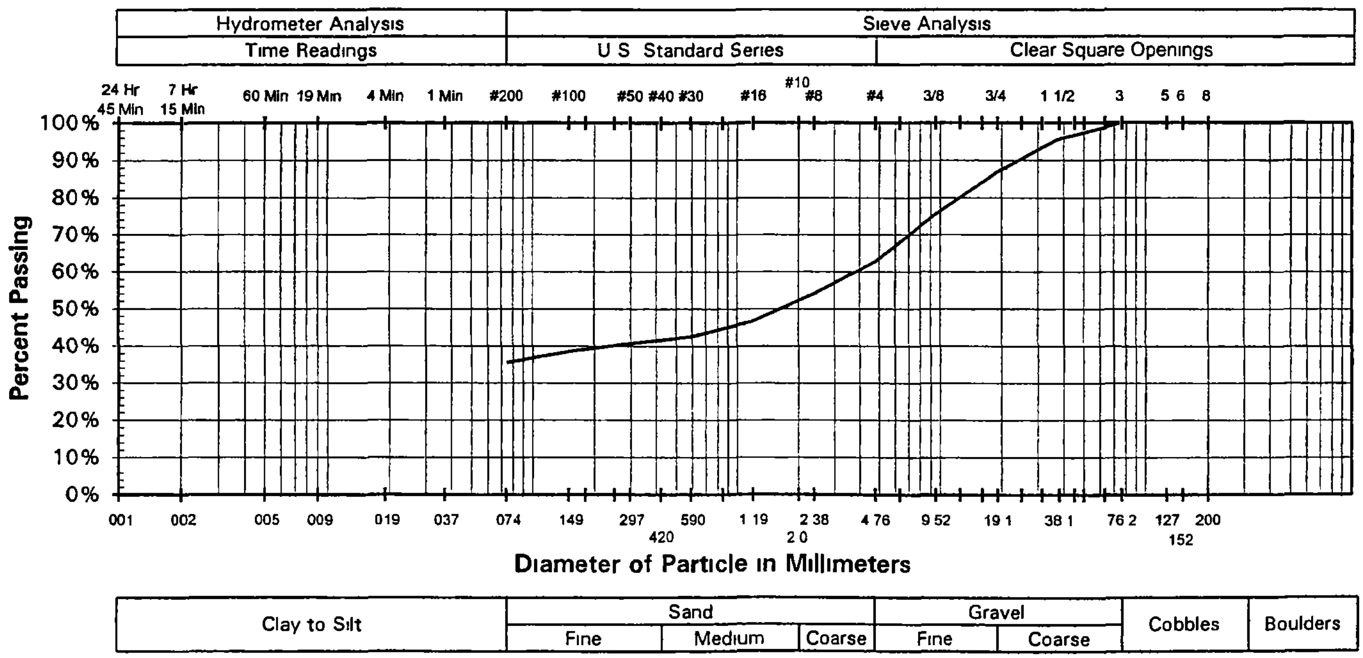
APPLIED GEOTECHNICAL ENGINEERING CONSULTANTS, INC



Project	Promontory Point
Sample Location	TP-21 @ 2'
Maximum Dry Density	124 pcf
Optimum Moisture	9%
Atterberg Limits	
Liquid Limit	34%
Plasticity Index	15%
Gradation	
Gravel	37%
Sand	27%
Silt & Clay	36%

Test Procedure ASTM D-698 C

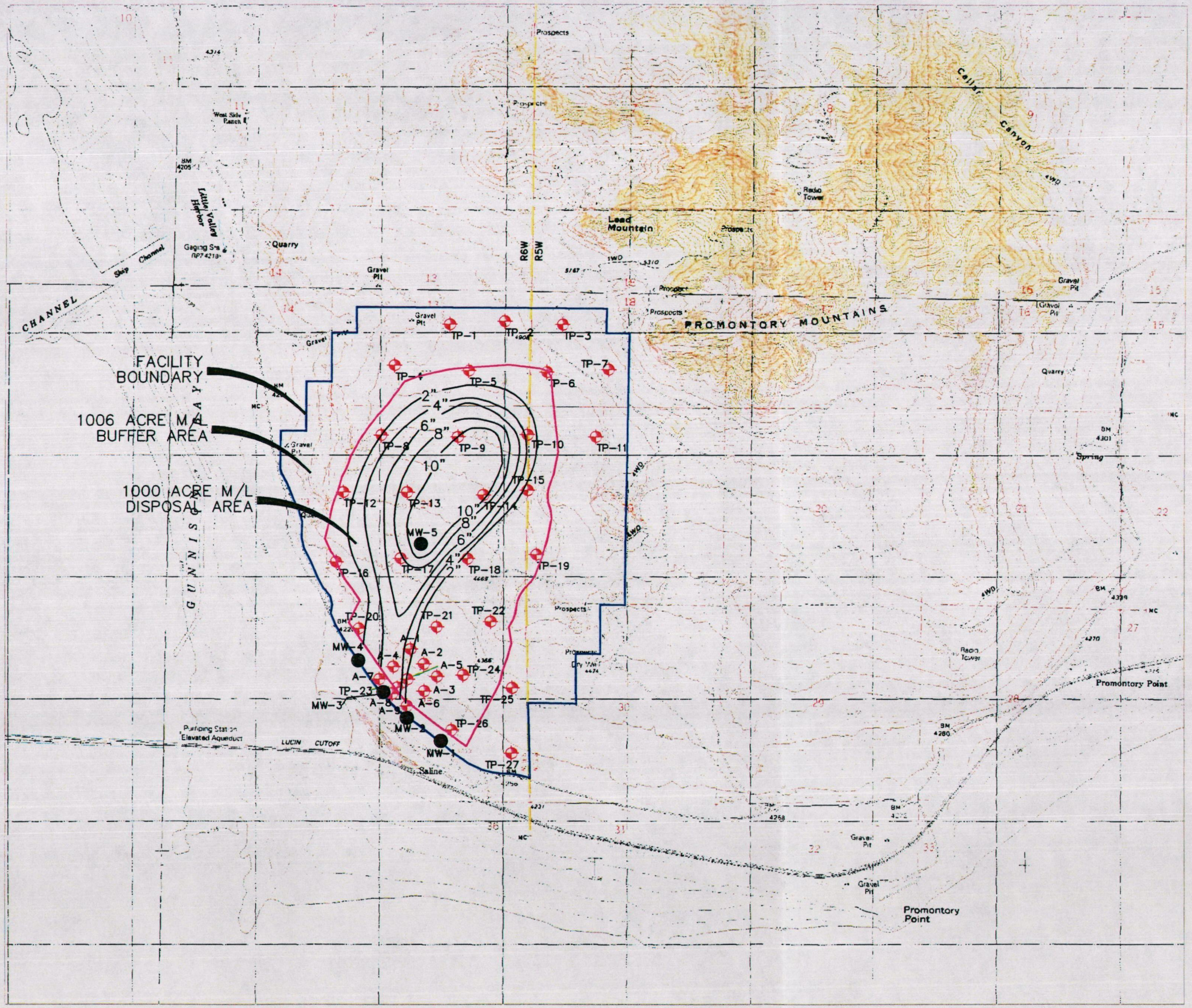
Sample Description Clayey Gravel with Sand (GC)



GRADATION & MOISTURE-DENSITY RELATIONSHIP

Project No 1020875

Figure 25



N
0 3000 6000 feet
Approximate Scale

PROMONTORY POINT LANDFILL
BOX ELDER COUNTY, UTAH

Note: The settlement estimate given is for the proposed 4:1 (H:V) slopes shown on the plan (Aqua Figure 4.5) dated December 2002. We have assumed 10' of soil to be removed. Bedrock strain is not included in the numbers shown and is estimated to be 0 to 6 inches.

Legend:
Test Pit Location
Monitor Well Location

1020875	AGEC	Foundation Settlement Estimate	Figure 26

APPLIED GEOTECHNICAL ENGINEERING CONSULTANTS, INC

TABLE I

SUMMARY OF LABORATORY TEST RESULTS

PROJECT NUMBER 1020875

SAMPLE LOCATION		NATURAL MOISTURE CONTENT (%)	NATURAL DRY DENSITY (PCF)	GRADATION			ATTERBERG LIMITS		STANDARD PROCTOR		SAMPLE CLASSIFICATION
BORING/ TEST PIT	DEPTH (FEET)			GRAVEL (%)	SAND (%)	SILT/ CLAY (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	MAXIMUM DRY DENSITY (PCF)	OPTIMUM MOISTURE CONTENT (%)	
MW 1	8	3	124	26	63	11					Poorly Graded Sand with Silt and Gravel
	23	13	120	23	41	36					Clayey Sand with Gravel
	38	8		43	42	15					Clayey Gravel with Sand
MW 2	13	6	114	38	41	21					Clayey Sand with Gravel
	33	6	117	52	24	24					Clayey Gravel with Sand
	38	7		65	20	15					Clayey Gravel with Sand
	58			53	33	14					Clayey Gravel with Sand
MW 3	23	4	119	38	47	15					Clayey Sand with Gravel
	28			62	22	16					Clayey Gravel with Sand
	43	7		40	54	6					Poorly Graded Sand with Silt and Gravel
MW 4	18	3	120	50	43	7					Poorly Graded Gravel with Silt and Sand
	48	8	132	25	60	15					Clayey Sand with Gravel
	53	13	124	31	47	22					Clayey Sand with Gravel
	88	11	130	39	40	21					Clayey Sand with Gravel
MW 5	28	18	113			72					Lean Clay with Sand

APPLIED GEOTECHNICAL ENG●FERING CONSULTANTS, INC

TABLE I

SUMMARY OF LABORATORY TEST RESULTS

PROJECT NUMBER 1020875

SAMPLE LOCATION		NATURAL MOISTURE CONTENT (%)	NATURAL DRY DENSITY (PCF)	GRADATION			ATTERBERG LIMITS		STANDARD PROCTOR		SAMPLE CLASSIFICATION
BORING/ TEST PIT	DEPTH (FEET)			GRAVEL (%)	SAND (%)	SILT/ CLAY (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	MAXIMUM DRY DENSITY (PCF)	OPTIMUM MOISTURE CONTENT (%)	
TP 1	2	9	74			96	26	6			Silty Clay
TP 2	4	8	87			63					Sandy Lean Clay
TP 3	2			39	47	14					Silty Sand with Gravel
TP 10	4			47	50	3					Poorly Graded Sand with Gravel
TP 11	9	15	102			73					Lean Clay with Sand
TP 13	2	14	98			90					Lean Clay
TP 18	4	6	97			35					Silty Sand
TP 19	5			53	45	2					Poorly Graded Gravel with Sand
TP 20	2	5	90			47					Clayey Sand
	2			6	43	51	19	5	118 5	11 5	Sandy Silty Clay
TP 21	2			37	27	36	34	15	124	9	Clayey Gravel with Sand

TABLE I

SUMMARY OF LABORATORY TEST RESULTS

PROJECT NUMBER 1020875

SAMPLE LOCATION		NATURAL MOISTURE CONTENT (%)	NATURAL DRY DENSITY (PCF)	GRADATION			ATTERBERG LIMITS		STANDARD PROCTOR		SAMPLE CLASSIFICATION
BORING/ TEST PIT	DEPTH (FEET)			GRAVEL (%)	SAND (%)	SILT/ CLAY (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	MAXIMUM DRY DENSITY (PCF)	OPTIMUM MOISTURE CONTENT (%)	
TP 23	4			35	64	1					Poorly Graded Sand with Gravel
	7	17	107			72					Lean Clay with Sand
TP 24	2			44	30	26					Clayey Gravel with Sand
	4			56	34	10					Well Graded Gravel with Silt and Sand
TP 27	2			10	70	20					Clayey Sand

APPENDIX

Stability and Settlement Calculations

Applied Geotechnical Engineering Consultants Inc

PROJECT NO 1020875 TITLE Promontory Point DATE 6/14/03 BY JRW

SUBJECT Long Term Stability SHEET ____ OF ____

Parameters

- Slope 4:1 (H:V)
- Waste Strength $\phi = 25°$ (Singh and Murphy, 1990)
- All other contacts between materials in cap will need to have friction angles $\geq 25°$

Static - infinite slope analysis

$$\frac{\tan 25°}{1/4} = 1.9 \quad \text{ok}$$

Seismic - pseudostatic/infinite slope analysis

- 10% in 250 year PGA = 0.55g (Frankel, et al 1996)
- M = 7
- $r \leq 10$ km
- From Figure 11.1 (SEEC/ASCE, 2002)

$f_{eq} = 0.39$ (15 cm deformation)

$f_{eq} = 0.51$ (5 cm deformation)

$$FS = \left[\frac{\cos\alpha}{\sin\alpha + K\cos\alpha}\right]\tan\phi$$

where k = seismic coeff
α = slope angle

15 cm deformation

$K = (0.39)(0.55g) = 0.215g$

$FS = 1.0$

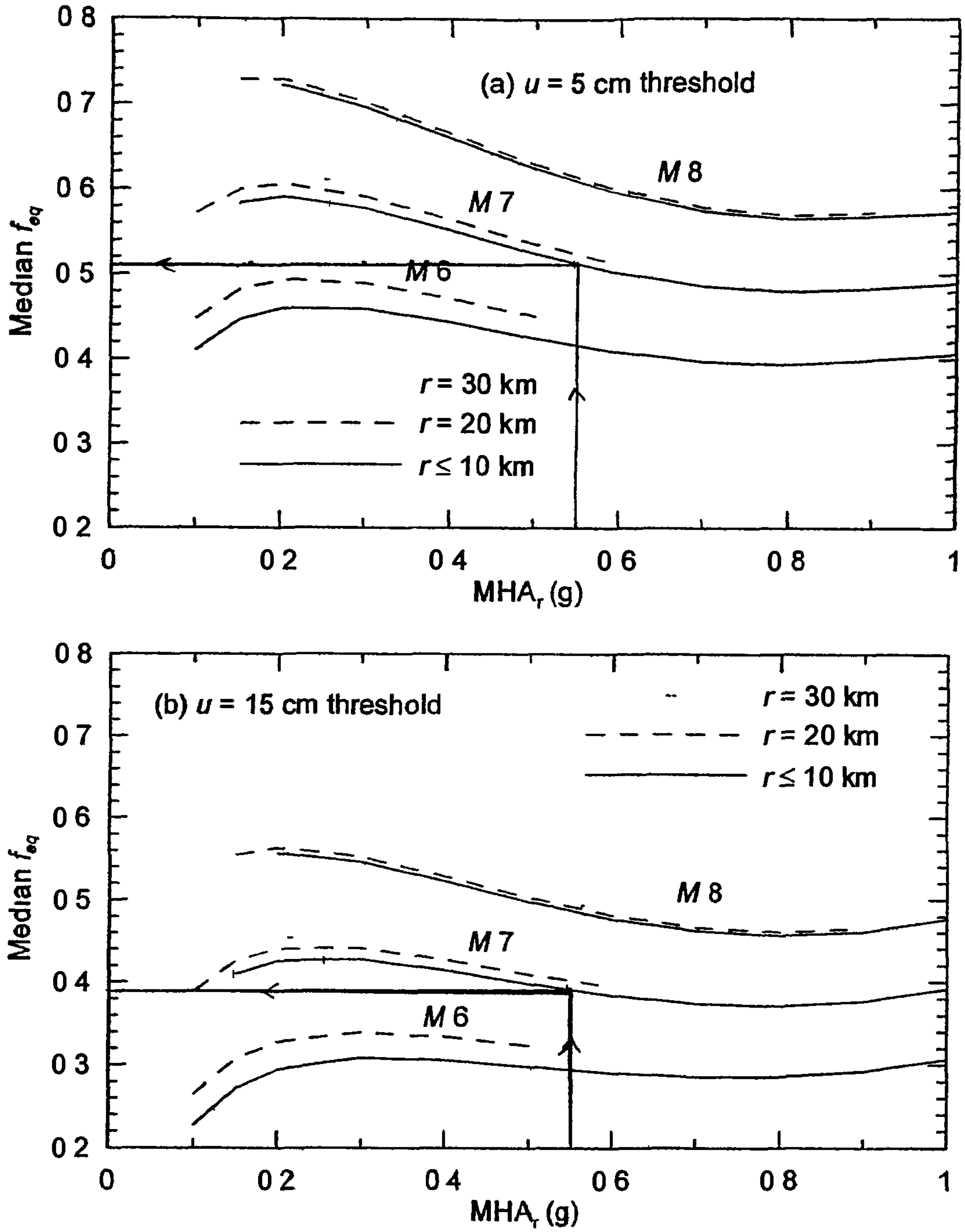


Figure 11 1 Required Values of f_{eq} as Function of MHA$_r$ and Seismological Condition for Threshold Displacements of (a) 5 cm and (b) 15 cm

Project 1020875
Promontory Point Landfill   Settlement Analysis

Soil Unit Weight   120
Waste Unit Weight   110

Test Pit Boring	Existing Elevation (ft)	Final Elevation (ft)	Fill height (ft)	Depth Top Layer (ft)	Depth Bottom Layer (ft)	Layer Thickne (ft)	Soil Type	C c	C r	Maximum Past Pressure (psf)	Po (psf)	Applied Pressure P (psf)	Po +P	recomp sett (in)	virgin sett (in)	total sett (in)	cumulative sett (in)
MW5	4440	4850	410	0	3	3	CL	0 068	0 008	4000	180	45100	45280	0 39	2 58	2 97	0 00
				3	10	7	SM	0 004	0 004	4000	780		45880	0 24	0 36	0 59	0 00
				10	15	5	SM	0 004	0 004	4000	1500		46600	0 10	0 26	0 36	0 36
				15	20	5	GP	0 004	0 004	4000	2100		47200	0 07	0 26	0 32	0 68
				20	25 5	5 5	CL	0 068	0 008	4000	2730		47830	0 09	4 84	4 92	5 61
				25 5	29	3 5	SP	0 004	0 004	4000	3270		48370	0 01	0 18	0 20	5 80
				29	31	2	CL	0 068	0 008	4000	3600		48700	0 01	1 77	1 78	7 58
				31	36	5	GC	0 004	0 004	4000	4020		49120	0 00	0 26	0 26	7 84
				36	41	5	GC	0 004	0 004	4000	4620		49720	0 00	0 25	0 25	7 83
MW5		max	800	0	3	3	CL	0 068	0 008	4000	180	88000	88180	0 39	3 29	3 68	0 00
				3	10	7	SM	0 004	0 004	4000	780		88780	0 24	0 45	0 69	0 00
				10	15	5	SM	0 004	0 004	4000	1500		89500	0 10	0 32	0 43	0 43
				15	20	5	GP	0 004	0 004	4000	2100		90100	0 07	0 32	0 39	0 82
				20	25 5	5 5	CL	0 068	0 008	4000	2730		90730	0 09	6 08	6 17	6 99
				25 5	29	3 5	SP	0 004	0 004	4000	3270		91270	0 01	0 23	0 24	7 23
				29	31	2	CL	0 068	0 008	4000	3600		91600	0 01	2 22	2 23	9 46
				31	41	10	GC	0 004	0 004	4000	4320		92320	0 00	0 64	0 64	10 10
TP 8	4680	4800	120	0	3	3	CL	0 068	0 008	4000	180	13200	13380	0 39	1 28	1 67	0 00
				3	6	3	GP	0 004	0 004	4000	540		13740	0 13	0 08	0 20	0 00
TP 10	4755	5000	245	0	8	8	SP	0 004	0 004	4000	480	26950	27430	0 35	0 32	0 67	0 00
				8	10	2	CL	0 068	0 008	4000	1080		28030	0 11	1 38	1 49	0 00
				10	11	1	CL	0 068	0 008	4000	1260		28210	0 05	0 69	0 74	0 74
				11	16	5	GP	0 004	0 004	4000	1620		28570	0 09	0 20	0 30	1 04
				16	21	5	GP	0 004	0 004	4000	2220		29170	0 06	0 21	0 27	1 31
				21	26	5	GP	0 004	0 004	4000	2820		29770	0 04	0 21	0 25	1 55
				26	30	4	GP	0 004	0 004	4000	3360		30310	0 01	0 17	0 18	1 74

TP 12	4520	4600	80	0	3	3	GP	0 004	0 004	4000	180	8800	8980	0 19	0 05	0 24	0 00
TP 13	4530	5000	470	0	5	5	CL	0 068	0 008	4000	300	51700	52000	0 54	4 54	5 08	0 00
				5	10	5	SM	0 004	0 004	4000	900		52600	0 16	0 27	0 42	0 00
				10	11	1	SM	0 004	0 004	4000	1260		52960	0 02	0 05	0 08	0 08
				11	20	9	GP	0 004	0 004	4000	1860		53560	0 14	0 49	0 63	0 71
				20	25 5	5 5	CL	0 068	0 008	4000	2730		54430	0 09	5 09	5 18	5 88
				25 5	29	3 5	SP	0 004	0 004	4000	3270		54970	0 01	0 19	0 21	6 09
				29	31	2	CL	0 068	0 008	4000	3600		55300	0 01	1 86	1 87	7 96
				31	36	5	GC	0 004	0 004	4000	4020		55720	0 00	0 27	0 27	8 24
				36	41	5	GC	0 004	0 004	4000	4620		56320	0 00	0 28	0 28	8 51
TP 14	4585	5250	665	0	5	5	SC/GP	0 004	0 004	4000	300	73150	73450	0 27	0 30	0 57	0 00
				5	10	5	SM	0 004	0 004	4000	900		74050	0 16	0 30	0 46	0 00
				10	11	1	SM	0 004	0 004	4000	1260		74410	0 02	0 06	0 09	0 09
				11	20	9	GP	0 004	0 004	4000	1860		75010	0 14	0 55	0 69	0 78
				20	25 5	5 5	CL	0 068	0 008	4000	2730		75880	0 09	5 74	5 82	6 60
				25 5	29	3 5	SP	0 004	0 004	4000	3270		76420	0 01	0 22	0 23	6 83
				29	31	2	CL	0 068	0 008	4000	3600		76750	0 01	2 09	2 10	8 93
				31	36	5	GC	0 004	0 004	4000	4020		77170	0 00	0 31	0 31	9 24
				36	41	5	GC	0 004	0 004	4000	4620		77770	0 00	0 31	0 31	9 55
TP 17	4425	4700	275	0	5	5	SC/GP	0 004	0 004	4000	300	30250	30550	0 27	0 21	0 48	0 00
				5	10	5	SM	0 004	0 004	4000	900		31150	0 16	0 21	0 37	0 00
				10	11	1	SM	0 004	0 004	4000	1260		31510	0 02	0 04	0 07	0 07
				11	20	9	GP	0 004	0 004	4000	1860		32110	0 14	0 39	0 53	0 60
				20	25 5	5 5	CL	0 068	0 008	4000	2730		32980	0 09	4 11	4 20	4 80
				25 5	29	3 5	SP	0 004	0 004	4000	3270		33520	0 01	0 16	0 17	4 97
				29	31	2	CL	0 068	0 008	4000	3600		33850	0 01	1 51	1 52	6 49
				31	41	10	GC	0 004	0 004	4000	4320		34570	0 00	0 45	0 45	6 94
TP 18	4462	5050	588	0	10	10	SP	0 004	0 004	4000	600	64680	65280	0 40	0 58	0 98	0 00
				10	14	4	SP	0 004	0 004	4000	1440		66120	0 09	0 23	0 32	0 32
TP 19	4600	4700	100	0	10	10	GP	0 004	0 004	4000	600	11000	11600	0 40	0 22	0 62	0 00
				10	14	4	GP	0 004	0 004	4000	1440		12440	0 09	0 09	0 18	0 18

TP 22	4450	4700	250	0	3	3	CL	0 068	0 008	4000	180	27500	27680	0 39	2 06	2 44	0 00
TP 21	4350	4700	350	0	5	5	GP	0 004	0 004	4000	300	38500	38800	0 27	0 24	0 51	0 00
TP 24	4325	4550	225	0	10	10	GP	0 004	0 004	4000	600	24750	25350	0 40	0 38	0 78	0 00
				10	11	1	GP	0 004	0 004	4000	1260		26010	0 02	0 04	0 06	0 06
TP 26	4260	4300	40	0	10	10	SC/GP	0 004	0 004	4000	600	4400	5000	0 40	0 05	0 44	0 00
				10	15	5	SC/GP	0 004	0 004	4000	1500		5900	0 10	0 04	0 14	0 14
				15	20	5	SC/GP	0 004	0 004	4000	2100		6500	0 07	0 05	0 12	0 26
				20	25	5	SC/GP	0 004	0 004	4000	2700		7100	0 04	0 06	0 10	0 36
				25	30	5	SC/GP	0 004	0 004	4000	3300		7700	0 00	0 07	0 07	0 43
				30	43	13	SC/GP	0 004	0 004	4000	3818 4		8218 4	0 00	0 20	0 20	0 62
A 4	4278	4350	72	0	7	7	SC/GP	0 004	0 004	4000	420	7920	8340	0 33	0 11	0 44	0 00
				7	10	3	CL	0 068	0 008	4000	1020		8940	0 17	0 86	1 03	0 00
				10	14	4	GP	0 004	0 004	4000	1440		9360	0 09	0 07	0 16	0 16
				14	20	6	CL	0 068	0 008	4000	2040		9960	0 17	1 94	2 11	2 26
				20	25	5	SP	0 004	0 004	4000	2700		10620	0 04	0 10	0 14	2 41
				25	30	5	SP	0 004	0 004	4000	3300		11220	0 02	0 11	0 13	2 53
				30	35	5	SP	0 004	0 004	4000	3900		11820	0 00	0 12	0 12	2 65
				35	40	5	SP	0 004	0 004	4000	4188		12108	0 00	0 11	0 11	2 76
				40	50	10	SP	0 004	0 004	4000	4764		12684	0 00	0 20	0 20	2 96
				50	60	10	SP	0 004	0 004	4000	5340		13260	0 00	0 19	0 19	3 15
				60	70	10	SP	0 004	0 004	4000	5916		13836	0 00	0 18	0 18	3 33
				70	80	10	SP	0 004	0 004	4000	6492		14412	0 00	0 17	0 17	3 50
				80	90	10	SP	0 004	0 004	4000	7068		14988	0 00	0 16	0 16	3 65
				90	100	10	SP	0 004	0 004	4000	7644		15564	0 00	0 15	0 15	3 80
A 8	4260	4300	40	0	3	3	SC/GP	0 004	0 004	4000	180	4400	4580	0 19	0 01	0 20	0 00
				3	10	7	CL	0 068	0 008	4000	780		5180	0 48	0 64	1 12	0 00
				10	17	7	CL	0 068	0 008	4000	1620		6020	0 26	1 01	1 28	1 28
				17	25	8	SP	0 004	0 004	4000	2520		6920	0 08	0 09	0 17	1 45
				25	30	5	SP	0 004	0 004	4000	3300		7700	0 02	0 07	0 09	1 53
				30	35	5	SP	0 004	0 004	4000	3900		8300	0 00	0 08	0 08	1 61
				35	40	5	SP	0 004	0 004	4000	4188		8588	0 00	0 07	0 07	1 69

40	50	10 SP	0 004	0 004	4000	4764	9164	0 00	0 14	0 14	1 82
50	60	10 SP	0 004	0 004	4000	5340	9740	0 00	0 13	0 13	1 95
60	70	10 SP	0 004	0 004	4000	5916	10316	0 00	0 12	0 12	2 07
70	80	10 SP	0 004	0 004	4000	6492	10892	0 00	0 11	0 11	2 17
80	90	10 SP	0 004	0 004	4000	7068	11468	0 00	0 10	0 10	2 27
90	100	10 SP	0 004	0 004	4000	7644	12044	0 00	0 09	0 09	2 37

APPENDIX E
WATER RIGHT INFORMATION

utah gov | State Online Services | Agency List | Search Utah gov go

UTAH DIVISION OF WATER RIGHTS

WRPRINT Water Right Information Listing

Version 2002 07 10 00 Rundate 12/06/2002 10 12 AM

Water Right 13-2072

Select Related Information

```
[WRPRINT] ***WR#  13 2072 has been PRINTED''
                              (WARNING  Water Rights makes NO claims as to the accuracy of this data ) RUN DATE  12/06/2002  Page 1
WRNUM  13-2072     APPLICATION/CLAIM NO                 CERT  NO
-----------------------------------------------------------------------------------------------------------------------------------
OWNERSHIP**************************************************************************************************************************
-----------------------------------------------------------------------------------------------------------------------------------
NAME  Young Resources Limited Partnership                          OWNER MISC
ADDR  4990 North Highway 38
CITY  Brigham City                  STATE  UT  ZIP  84302      INTEREST  100%
LAND OWNED BY APPLICANT?
-----------------------------------------------------------------------------------------------------------------------------------
DATES  ETC ************************************************************************************************************************
-----------------------------------------------------------------------------------------------------------------------------------
FILING       /  /    |PRIORITY   00/00/1930|ADV BEGAN     /  /     |ADV ENDED     /  /     |NEWSPAPER
PROTST END   /  /    |PROTESTED  [   ]     |APPR/REJ  [          ]|APPR/REJ      /  /     |PROOF DUE     /  /     |EXTENSION     /  /
ELEC/PROOF [        ]|ELEC/PROOF   /  /    |CERT/WUC   03/30/1968|LAP  ETC      /  /     |PROV LETR     /  /     |RENOVATE      /  /
PD Book No   3  Type of Right  DIL   Status        Source of Info  PDET  Map  232      Date Verified  08/02/1996  Initials  JPJ
-----------------------------------------------------------------------------------------------------------------------------------
LOCATION OF WATER RIGHT************************************************************************************************************
-----------------------------------------------------------------------------------------------------------------------------------
FLOW  0 015 cfs                                       SOURCE  Underground Water Well
COUNTY  Box Elder    COMMON DESCRIPTION  Promontory Point
POINT OF DIVERSION -- UNDERGROUND
(1) N 1900 ft W  350 ft from S4 cor, Sec 25, T  6N  R  6W, SLBM DIAM     ins  DEPTH       to      ft  YEAR DRILLED      WELL LOG?
         Comment
-----------------------------------------------------------------------------------------------------------------------------------
USES OF WATER RIGHT****************************************************************************************************************
-----------------------------------------------------------------------------------------------------------------------------------
CLAIMS USED FOR PURPOSE DESCRIBED  1947  2072
     Referenced To             Claims Groups                          Type of Reference -- Claims     Purpose     Remarks

  ###STOCKWATERING  810 Cattle or Equivalent                         Diversion Limit           acft  PERIOD OF USE  01/01 TO 12/31
IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII E N D   O F   D A T A IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII
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oooooooooooooooooooooooooooooooooooooooooooooooooooooo E N D   O F   D A T A oooooooooooooooooooooooooooooooooooooooooooooooooooooooo

UTAH DIVISION OF WATER RIGHTS

WRPRINT Water Right Information Listing

Version 2002 07 10 00 **Rundate** 12/06/2002 10 10 AM

Water Right 13-2774

Select Related Information

```
[WRPRINT] ***WR#  13 2774 has been PRINTED''
                            (WARNING  Water Rights makes NO claims as to the accuracy of this data ) RUN DATE  12/06/2002  Page 1
WRNUM  13-2774      APPLICATION/CLAIM NO   A41097       CERT  NO
-------------------------------------------------------------------------------------------------------------------------------------
OWNERSHIP****************************************************************************************************************************
-------------------------------------------------------------------------------------------------------------------------------------
NAME  Lake Crystal Salt Co                                          OWNER MISC
ADDR  720 Exchange Lane P O  Box 1149
CITY  Ogden                            STATE  UT  ZIP  84402        INTEREST
LAND OWNED BY APPLICANT? No
-------------------------------------------------------------------------------------------------------------------------------------
DATES, ETC ***************************************************************************************************************************
-------------------------------------------------------------------------------------------------------------------------------------
FILING     01/28/1972|PRIORITY   01/28/1972|ADV BEGAN    /  /     |ADV ENDED     /  /     |NEWSPAPER
PROTST END   /  /    |PROTESTED  [   ]     |APPR/REJ   [         ]|APPR/REJ   06/19/1972|PROOF DUE    /  /     |EXTENSION     /  /
ELEC/PROOF [Election]|ELEC/PROOF 07/11/1974|CERT/WUC   01/31/1975|LAP  ETC      /  /     |PROV LETR    /  /     |RENOVATE      /  /
PD Book No      Type of Right  APPL  Status  WUCS  Source of Info  WUC   Map  232       Date Verified  02/19/1986  Initials  FW
-------------------------------------------------------------------------------------------------------------------------------------
LOCATION OF WATER RIGHT**************************************************************************************************************
-------------------------------------------------------------------------------------------------------------------------------------
FLOW  0 011 cfs                                       SOURCE  Underground Water Well
COUNTY  Box Elder    COMMON DESCRIPTION  Promontory Mountains
POINT OF DIVERSION -- UNDERGROUND
(1) N 2700 ft W  100 ft from SE cor  Sec 25  T  6N  R  6W  SLBM DIAM   6 ins  DEPTH    70 to  100 ft  YEAR DRILLED      WELL LOG?
          Comment
-------------------------------------------------------------------------------------------------------------------------------------
USES OF WATER RIGHT******************************************************************************************************************
-------------------------------------------------------------------------------------------------------------------------------------
CLAIMS USED FOR PURPOSE DESCRIBED  2774
     Referenced To              Claims Groups                       Type of Reference -- Claims     Purpose     Remarks

  ###IRRIGATION        *---NORTH WEST QUARTER--*---NORTH EAST QUARTER--*---SOUTH WEST QUARTER--*---SOUTH EAST QUARTER--*   Section
 Tot Irr  Acrg      1 00*  NW     NE     SW     SE *  NW     NE     SW     SE *  NW     NE     SW     SE *  NW     NE     SW     SE *   Totals
  Sec 24 T  6N R  6W SLBM *                         *                         *                         *           1 00      *      1 00
```

```
    or a Total of 1 00 acres
                                   Sole Supply            acres  Diversion Limit            acft  PERIOD OF USE  04/01 TO 10/31

  ###DOMESTIC  4 Families                                        Diversion Limit            acft  PERIOD OF USE  01/01 TO 12/31
-----------------------------------------------------------------------------------------------------------------------------------
OTHER COMMENTS*********************************************************************************************************************
-----------------------------------------------------------------------------------------------------------------------------------
    The applicant has a lease agreement with D H  Adams for 50 years with a option
    to renew
IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII E N D   O F   D A T A IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII
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OOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOO E N D   O F   D A T A OOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOO
```

UTAH DIVISION OF WATER RIGHTS

WELLPRT Well Log Information Listing

Version 2002 04 04 00 Rundate 12/06/2002 10 11 AM

Utah Division of Water Rights

Water Well Log

LOCATION
N 2700 ft W 100 ft from SE CORNER of SECTION 25 T 6N R 6W BASE SL Elevation feet

DRILLER ACTIVITIES
ACTIVITY # 1 NEW WELL
DRILLER Lee & Sons Drilling LICENSE # 11
START DATE 09/07/1972 COMPLETION DATE 12/15/1972

BOREHOLE INFORMATION

Depth(ft) From	To	Diameter(in)	Drilling Method	Drilling Fluid
0	200	8	CABLE	

LITHOLOGY

Depth(ft) From	To	Lithologic Description	Color	Rock Type
0	5	CLAY SAND		
5	74	CLAY BOULDERS		
74	178	OTHER		BEDROCK
178	198	OTHER		BEDROCK FRACT
198	200	OTHER		BEDROCK SOLID

WATER LEVEL DATA

Date	Time	Water Level (feet) (-)above ground	Status
12/15/1972		169 00	STATIC

CONSTRUCTION - CASING

Depth(ft) From	To	Material	Gage(in)	Diameter(in)
0	200		250	8

CONSTRUCTION - SCREENS/PERFORATIONS

Depth(ft) From	To	Screen(S) or Perforation(P)	Slot/Perf siz	Screen Diam/Length Perf(in)	Screen Type/# Perf
180	195	PERFORATION	25	1 50	150

WELL TESTS

Date	Test Method	Yield (CFS)	Drawdown (ft)	Time Pumped (hrs)
12/15/1972	BAILER TEST	058		30

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UTAH DIVISION OF WATER RIGHTS

WRPRINT Water Right Information Listing

Version 2002 07 10 00 Rundate 12/06/2002 10 09 AM

Water Right 13-1947

Select Related Information

```
[WRPRINT] ***WR#  13 1947 has been PRINTED''
                    (WARNING  Water Rights makes NO claims as to the accuracy of this data ) RUN DATE  12/06/2002  Page 1
WRNUM  13-1947     APPLICATION/CLAIM NO              CERT  NO
-------------------------------------------------------------------------------------------------------------------------------
OWNERSHIP**********************************************************************************************************************
-------------------------------------------------------------------------------------------------------------------------------
NAME  Young Resources Limited Partnership                       OWNER MISC
ADDR  4990 North Highway 38
CITY  Brigham City                STATE  UT  ZIP  84302        INTEREST  100%
LAND OWNED BY APPLICANT?
-------------------------------------------------------------------------------------------------------------------------------
DATES, ETC *******************************************************************************************************************
-------------------------------------------------------------------------------------------------------------------------------
FILING        / /    |PRIORITY   00/00/1930|ADV BEGAN    / /    |ADV ENDED    / /    |NEWSPAPER
PROTST END    / /    |PROTESTED  [    ]    |APPR/REJ   [          ]|APPR/REJ    / /    |PROOF DUE    / /    |EXTENSION    / /
ELEC/PROOF [        ]|ELEC/PROOF    / /    |CERT/WUC   04/30/1968|LAP  ETC     / /    |PROV LETR    / /    |RENOVATE     / /
PD Book No   3  Type of Right  DIL   Status          Source of Info  PDET  Map  232      Date Verified  08/02/1996  Initials  JPJ
-------------------------------------------------------------------------------------------------------------------------------
LOCATION OF WATER RIGHT********************************************************************************************************
-------------------------------------------------------------------------------------------------------------------------------
FLOW  0 015 cfs                                        SOURCE  Underground Water Well
COUNTY  Box Elder    COMMON DESCRIPTION
POINT OF DIVERSION -- UNDERGROUND
(1) S 1600 ft E 1000 ft from NW cor, Sec 29  T  6N, R  5W, SLBM DIAM     ins  DEPTH       to       ft  YEAR DRILLED       WELL LOG?
          Comment
-------------------------------------------------------------------------------------------------------------------------------
USES OF WATER RIGHT************************************************************************************************************
-------------------------------------------------------------------------------------------------------------------------------
CLAIMS USED FOR PURPOSE DESCRIBED  1947 2072
     Referenced To              Claims Groups                       Type of Reference -- Claims    Purpose      Remarks

  ###STOCKWATERING  810 Cattle or Equivalent                        Diversion Limit     22 68 acft  PERIOD OF USE  01/01 TO 12/31
IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII E N D   O F   D A T A IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX                       XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
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UTAH DIVISION OF WATER RIGHTS

WRPRINT Water Right Information Listing

Version 2002 07 10 00 Rundate 12/06/2002 10 08 AM

Water Right 13-3733

Select Related Information

```
[WRPRINT] ***WR#  13 3733 has been PRINTED''
                         (WARNING  Water Rights makes NO claims as to the accuracy of this data ) RUN DATE  12/06/2002  Page 1
WRNUM  13-3733      APPLICATION/CLAIM NO   A72115       CERT  NO
---------------------------------------------------------------------------------------------------------------------------------
OWNERSHIP************************************************************************************************************************
---------------------------------------------------------------------------------------------------------------------------------
NAME  Young Resources Ltd  P                                      OWNER MISC
ADDR  4990 North Highway 38
CITY  Brigham City                 STATE  UT  ZIP  84302          INTEREST
LAND OWNED BY APPLICANT? Yes
---------------------------------------------------------------------------------------------------------------------------------
DATES  ETC **********************************************************************************************************************
---------------------------------------------------------------------------------------------------------------------------------
FILING     05/03/1999|PRIORITY   05/03/1999|ADV BEGAN  05/26/1999|ADV ENDED  06/02/1999|NEWSPAPER   The Leader
PROTST END 06/22/1999|PROTESTED  [No ]      |APPR/REJ   [Approved]|APPR/REJ   08/13/1999|PROOF DUE  08/31/2008|EXTENSION     /  /
ELEC/PROOF [         ]|ELEC/PROOF    /  /     |CERT/WUC      /  /     |LAP  ETC      /  /     |PROV LETR    /  /     |RENOVATE      /  /
PD Book No       Type of Right  APPL  Status  APP   Source of Info  APPL  Map             Date Verified  05/11/1999  Initials  JMJ
---------------------------------------------------------------------------------------------------------------------------------
LOCATION OF WATER RIGHT**********************************************************************************************************
---------------------------------------------------------------------------------------------------------------------------------
FLOW  1 73 acre-feet                                    SOURCE  Underground Water Well
COUNTY  Box Elder    COMMON DESCRIPTION  Promontory Point
POINT OF DIVERSION -- UNDERGROUND
(1) S  535 ft E 2112 ft from NW cor  Sec 20  T  6N  R  5W  SLBM DIAM   8 ins  DEPTH   100 to  400 ft  YEAR DRILLED       WELL LOG?
         Comment
---------------------------------------------------------------------------------------------------------------------------------
PLACE OF USE OF WATER RIGHT******************************************************************************************************
---------------------------------------------------------------------------------------------------------------------------------
                              NORTH-WEST4      NORTH-EAST4      SOUTH-WEST4      SOUTH-EAST4
                              NW NE SW SE      NW NE SW SE      NW NE SW SE      NW NE SW SE
Sec 20 T  6N R  5W SLBM     *    X     *     *          *     *          *     *          *
---------------------------------------------------------------------------------------------------------------------------------
USES OF WATER RIGHT**************************************************************************************************************
---------------------------------------------------------------------------------------------------------------------------------
```

```
CLAIMS USED FOR PURPOSE DESCRIBED  3733
    Referenced To             Claims Groups                               Type of Reference -- Claims     Purpose     Remarks

  ###STOCKWATERING  61 Cattle or Equivalent                                 Diversion Limit          acft  PERIOD OF USE  01/01 TO 12/31
-------------------------------------------------------------------------------------------------------------------------------------
APPLICATIONS FOR EXTENSIONS OF TIME WITHIN WHICH TO SUBMIT PROOF*********************************************************************
-------------------------------------------------------------------------------------------------------------------------------------
FILING     08/20/2002|PUB BEGAN    / /     |PUB ENDED     / /     |NEWSPAPER
PROTST END   / /     |PROTESTED  [         ]|APPR/REJECT[Approved]|APPR/REJ   09/30/2002|PROOF DUE  08/31/2008
-------------------------------------------------------------------------------------------------------------------------------------
IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII E N D   O F   D A T A IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII
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UTAH DIVISION OF WATER RIGHTS

WELLPRT Well Log Information Listing

Version 2002 04 04 00 Rundate 12/06/2002 10 09 AM

Utah Division of Water Rights

Water Well Log

LOCATION

S 535 ft E 2112 ft from NW CORNER of SECTION 20 T 6N R 5W BASE SL Elevation feet

DRILLER ACTIVITIES

ACTIVITY # 1 NEW WELL
DRILLER NELSON DRILLING COMPANY LICENSE # 596
START DATE 11/08/1999 COMPLETION DATE 11/09/1999

BOREHOLE INFORMATION

Depth(ft) From	To	Diameter(in)	Drilling Method	Drilling Fluid
0	20	12 2	AIR ROTARY	NONE
20	240	7 87	AIR ROTARY	NONE

LITHOLOGY

Depth(ft) From	To	Lithologic Description	Color	Rock Type
0	2	LOW-PERMEABILITY OTHER	BRN	OVERBURDEN
2	38	LOW-PERMEABILITY CLAY GRAVEL		
38	73	LOW-PERMEABILITY,OTHER	RED	SOFT SHALE
73	139	LOW-PERMEABILITY,OTHER	RED	HARD SHALE
139	162	LOW-PERMEABILITY,OTHER	RED	SOFT SHALE
162	240	LOW-PERMEABILITY,OTHER	RED	HARD SHALE
		NOT A DROP OF WATER NOT EVEN ANY DAMP GROUND		

WATER LEVEL DATA

Date	Time	Water Level (feet) (-)above ground	Status
11/09/1999		00	

CONSTRUCTION - CASING

Depth(ft) From	To	Material	Gage(in)	Diameter(in)
+1	20	STEEL A 53	250	8

CONSTRUCTION - FILTER PACK/ANNULAR SEALS

Depth(ft) From	To	Material	Amount	Density(pcf)
0	20	BENTONITE PELLETS		500

GENERAL COMMENTS

CONSTRUCTION INFORMATION
Well Head Configuration dry well
Casing pulled casing & plugged hole
ADDITIONAL DATA NOT AVAILABLE

APPENDIX F
CULTURAL AND ENVIRONMENTAL

P-III Associates, Inc
Cultural Resource Consultants

2759 South 300 West, Suite A
Salt Lake City, Utah 84115-2955
(801) 467-5446

August 5, 2003

Mr Michael J Forrest
Special Projects
Pacific West LLC
1515 South 2200 West, Suite C
Salt Lake City, UT 84119

RE Cultural resources reconnaissance of the Promontory Landfill Area in Box Elder County Cultural Resources Report 5204-01-20311

Dear Mr Forrest

As per the subcontract agreement between Pacific West and P-III Associates (dated July 16, 2003), our firm conducted a cultural resources reconnaissance of approximately 2000 acres of private land associated with the Promontory Landfill project in Box Elder County A cultural resources reconnaissance inventory is designed to identify major archeological sites in the area One major archeological site was found in the parcel This site is located within the 2000-acre buffer zone and will not be impacted by landfill activities

Prior to the fieldwork, P-III Associates staff archeologist Greg H Miller conducted a file search at the State Historic Preservation Office on July 15, 2003 to determine if any previously recorded sites or properties existed within the project area The file search did not identify any previously recorded sites within the project area, although a number of known important cave and rockshelter sites have been recorded in and around the Promontory region

On July 25, 2003, two staff archeologists from P-III Associates conducted reconnaissance of the entire project area Using a four-wheel-drive vehicle, the crew did a brief visual reconnaissance of the project area and then stopped and performed on-foot inspections of areas of high relief in the eastern and western parts of the parcel, searching for rock art, prehistoric caves and rockshelters, historic mining camps, and any other type of cultural resource site One archeological site was discovered by the crew This site is a small rockshelter overlooking Gunnison Bay to the west The site consists of a rockshelter located in a quartzite outcrop and an associated midden The shelter measures 5 0 m deep by 2 4 m wide by 2 0 m high and the entrance faces southwest at a 220° azimuth Approximately 20 pieces of obsidian debitage (mostly bifacial thinning flakes), 1 gray chert core reduction flake, and a small projectile point (likely a Desert Side-notched) were noted on the surface of the midden The only artifact visible within the shelter itself is an obsidian bifacial thinning flake The midden extends out approximately 5 m from the shelter entrance and appears to be at least 1 m deep The shelter roof appears to exhibit smoke blackening This site is located on the eastern edge of the high-relief area It is in excellent condition, is undisturbed, and has not been looted because the site is not visible from the road that passes below Evaluation by our field team suggests that the site contains information that is significant to the Protohistoric period and earlier times of prehistoric occupation This site is potentially eligible for inclusion in the National Register of Historic Places (NRHP)

Because the site is potentially eligible for inclusion in the NRHP, measures should be taken to protect it from any damage during construction and use of the landfill and to ensure that the site is not disturbed or looted If the site cannot be protected in situ, it is recommended that a data recovery project be implemented to recover the significant archeological data

We appreciate the opportunity to conduct this project for you Please feel free to call me if you have any questions

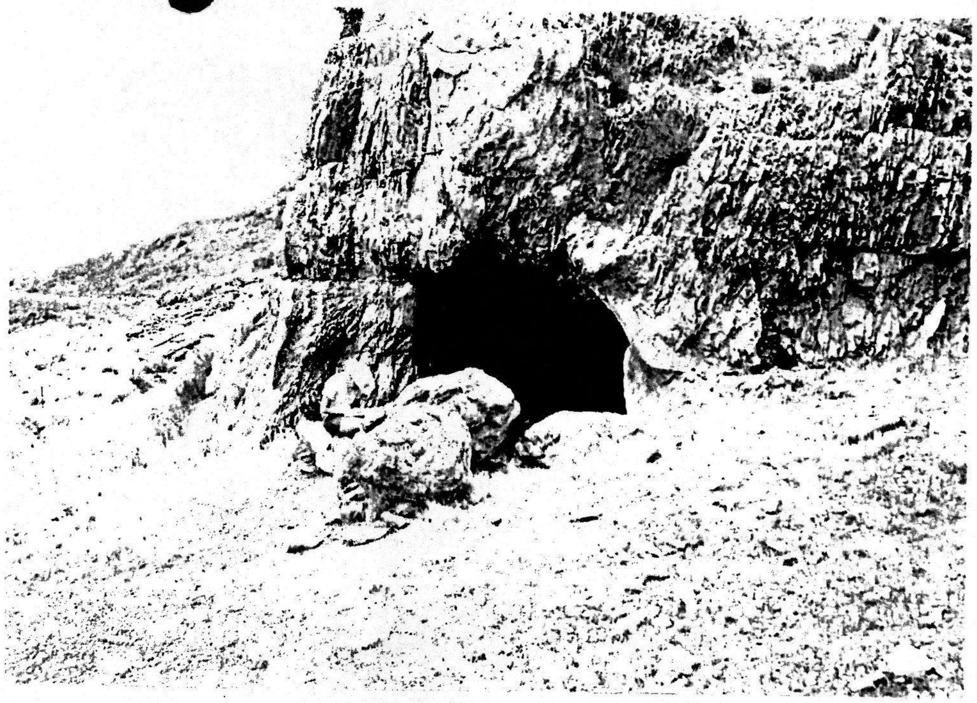
Sincerely,

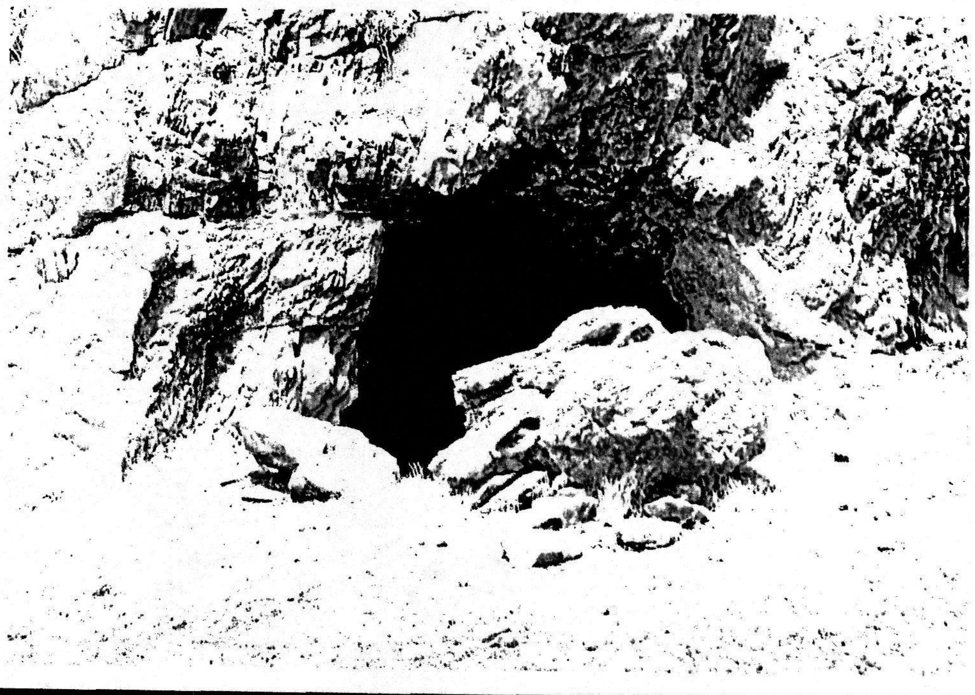
Alan R Schroedl
Senior Consultant

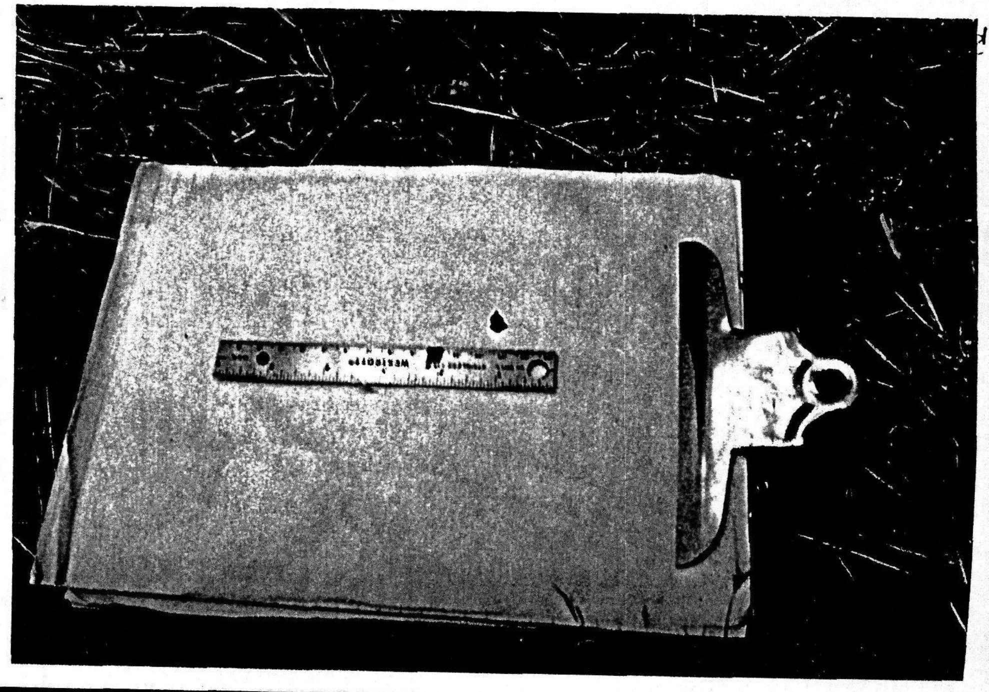
ARS/sel

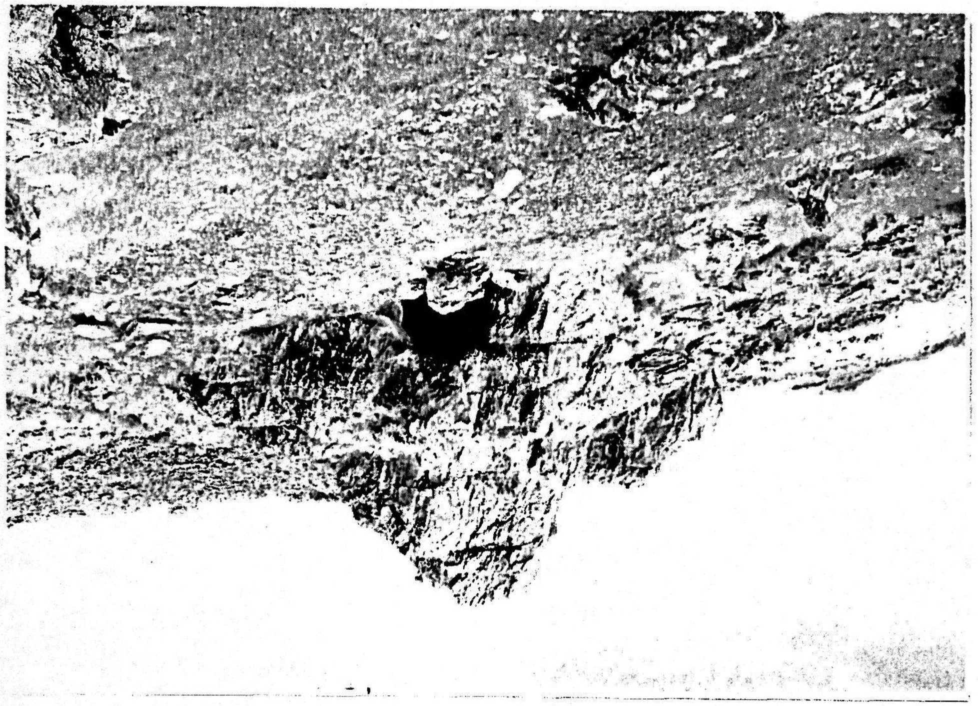
Enclosure Photos of rockshelter site
U S G S map showing the locations of the project area and the rockshelter

01-20311



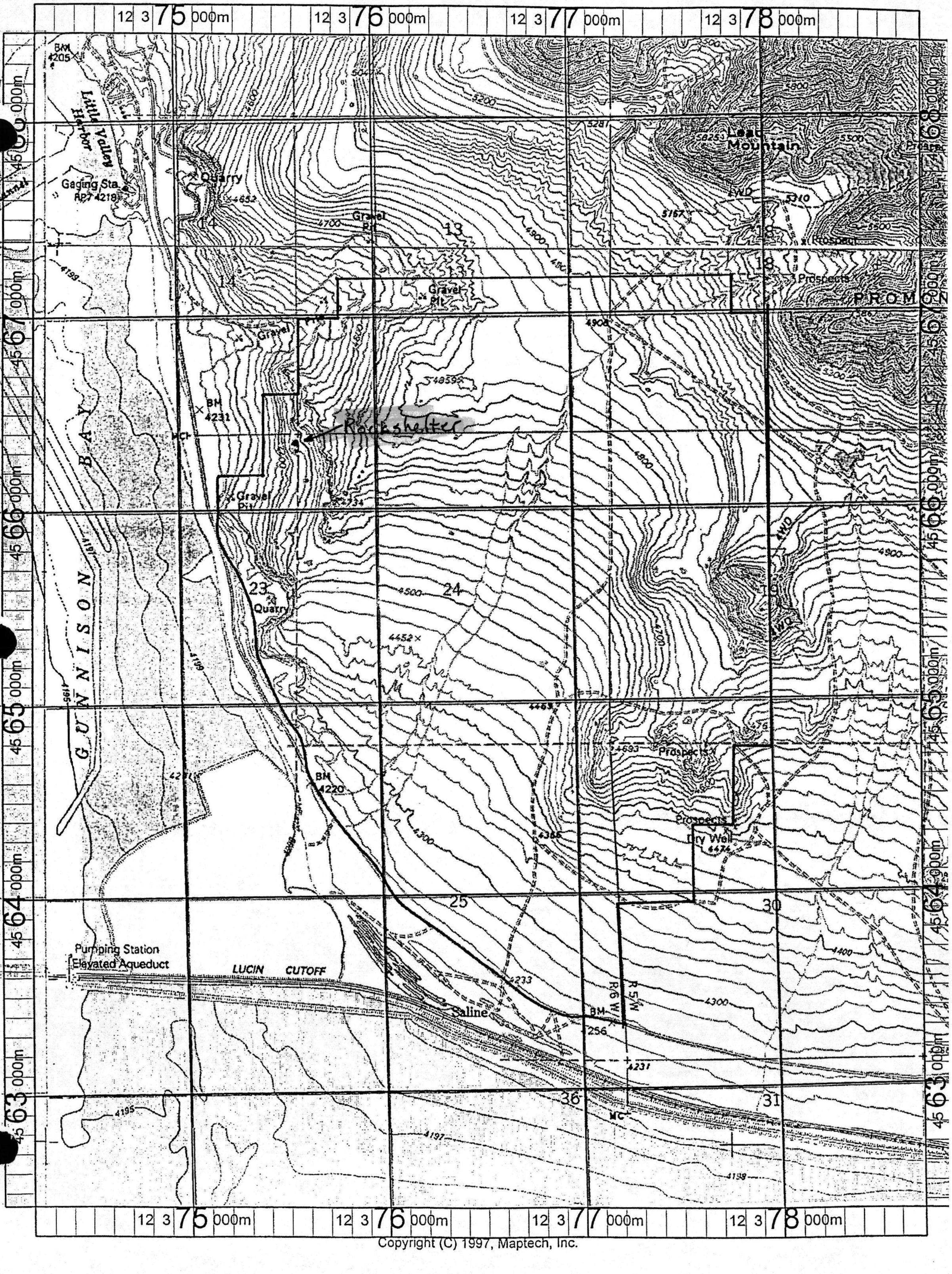






Rockshelter 5204-01 Roll 96 Neg 4

Rockshelter 5204-01 Roll 96 Neg 5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12 3 77 000m
12 3 78 000m
45 68 000m
45 67 000m
45 66 000m
45 65 000m
45 64 000m
45 63 000m
BM 4205
Little Valley Harbor
Gaging Sta.
Quarry
Gravel Pit
Lead Mountain
Prospect
Prospects
PROMON
BM 4231
Rockshelter
GUNNISON BAY
Quarry
BM 4220
Prospects
Dry Well
Pumping Station
Elevated Aqueduct
LUCIN CUTOFF
Saline
R 6 W
R 5 W
BM 4256

June 23, 2003

Mark Easton
Solid Waste Director
1515 West 2200 South, Suite C
Salt Lake City, Utah 84074

Dear Mr Easton,

The Fish and Wildlife Service (Service) has reviewed the materials included with your letter of June 3, 2003 regarding the Promontory Point Landfill Project The project as proposed would construct and operate a municipal landfill on Promontory Point, Box Elder County, Utah Waste would be carried to the site via rail car or truck from municipalities located along the Wasatch Front at a rate exceeding 1200 tons per day, for a period of 60 to 80 years The landfill would not accept any hazardous, septic, sump, or chemical waste during the life of the landfill Based on conversations during the site visit and contrary to the written proposal, a total of four monitoring wells would be installed to monitor groundwater within the footprint of the landfill, rather than three The additional well would be down slope of the project area We are providing the following comments for your consideration in your project

The Service believes that a site specific wildlife analysis should be conducted The analysis provided in the proposal is too general and can be misleading in that it lists several species as "found in the area" that are highly unlikely to be present and excludes some that were present during our site visit Sagebrush was not included in the list of plant species under "Site Description" and was only listed as a dominant "shrub type" under "Vegetation" yet sagebrush was the dominant *plant* type and *community* type within the footprint of the project that was observed during the site visit It is extremely important to have accurate resource accounts in order to properly assess the impacts of the project on wildlife

The Service recommends a plan that would maximize the wildlife value of the buffer strip surrounding the landfill The site visit showed a large amount of sagebrush habitat that was being currently used by a variety of wildlife, including black-tail jackrabbit, coyote, mule deer, northern sagebrush lizard, turkey vulture, ground squirrel, and mourning dove Not only could this buffer area provide valuable habitat during the life of the project, it could be an important seed/colonization source for plants and wildlife after the landfill has been reclaimed

The Service is concerned with the potential impacts the landfill may have on nearby gull and pelican colonies Specifically, we are concerned the landfill may act as an attractant for gulls and this may result in an increase in pelican predation at the nearby rookery We recommend a literature review to see what similar impacts may have occurred at other landfills and what measures were taken in those instances to mitigate impacts

We suggest that the proponent explore the use of non-lethal barriers for excluding gulls and other birds and wildlife from exposed evaporation ponds Specifically, the use of netting may be a practical means to keep volant wildlife from using the ponds Mesh size should be carefully considered to avoid injury or death of birds and bats that may be using the area

It is unclear whether site-specific soil analysis has been or will be done The document provided to us states that soil data was taken from a 1975 USDA SCS document that covers the eastern part of Box Elder County Site-specific geology and soil type may be important to accurately model subsurface flow of potential contaminants

The Service strongly recommends that waste be bailed or otherwise contained prior to transport to the proposed facility and that a monitoring protocol be developed to assess the amount of waste escaping the landfill and subsequently landing in the Great Salt Lake There are a multitude of common trash items known to be deadly to birds and other wildlife Any means by which to reduce exposure of these items to wildlife would improve the project

Thank you for the opportunity to comment on this project and for the time you took to accommodate a site visit If we can be of further assistance, or if you have any questions, please feel free to contact Chris Witt of our office at (801) 975-3330 extension 133

Sincerely,

Henry R Maddux
Utah Field Supervisor

cc UDWR - Ogden

bcc Project file
Reading file

file Z /Witt/Promontory_Landfill_062303

FRONTIER CORPORATION USA
Environmental Consultants

MEMORANDUM

DATE August 18, 2003

TO Mike Forest, Pacific West LLC

FROM Sarah G Lupis, Wildlife Biologist
Dennis Wenger, Project Manager, Sr Wetlands Ecologist

SUBJECT Gulls, landfills, and pelicans An assessment of potential landfill effects to the Gull and American White Pelican populations on Gunnison Island
Literature Review and Technical Memorandum

INTRODUCTION

Frontier Corporation USA (Frontier) was asked to conduct a literature review and prepare a technical memorandum addressing the potential effects of landfills on gull populations and the potential impacts of increased gull abundance on nearby nesting bird colonies Specifically, this report addresses the potential for increased gull (*Larus* spp) predation on the American white pelican (*Pelecanus erythrorhynchos*) colony on Gunnison Island in the Great Salt Lake resulting from development of a proposed municipal solid waste landfill on Promontory Point, Utah

An online literature search was conducted through the Utah State University (USU) library system Journal databases searched included Wildlife Worldwide, AGRICOLA, and Ecological Abstracts Databases were queried using keywords such as gull, landfill, dump, predation, and pelican on their own and in combination Relevant material was obtained from the USU Science and Technology Library in Logan, Utah

Several authors reported that gulls use landfills for foraging, loafing, and social interactions (Belant et al 1988, Belant et al 1995, Belant et al 1993, Patton 1988, Harris 1970) Several factors contribute to the use of landfills by gulls including landfill management techniques, migratory patterns, age of gull, gull sex, and proximity of landfill to potential nesting and staging habitat

Gulls are opportunistic predators and scavengers They have been known to prey on eggs and young of waterfowl and shorebird species including ducks, terns, cormorants, oystercatchers, several species of geese, and pelicans (Schmutz et al 2001, Belant 1997, Yorio and Quintana 1997, Harris and Wanless 1997, Guillemette and Brousseau 1991, Braun et al 1980, Anderson 1965, Behle 1935) The degree to

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which gull predation limits populations of nesting waterfowl and shorebirds is still being debated in the literature

The first account of nesting pelicans in the Great Salt Lake are from the exploration party lead by Howard Stansbury in 1850 (Parrish et al 2002 and Behle 1935) Historically, pelicans nested on Egg Island, Badger Island, Gunnison Island, and Hat Island (Parrish et al 2002 and Behle 1935) Today, Gunnison Island is the only home to breeding pelicans in the state of Utah and has been identified as one of the three most stable and reproductive breeding sites on the continent (Parrish et al 2002) No studies or reports were found that indicate why pelican colonies have disappeared from the other islands in the Great Salt Lake Although many other North American pelican colonies have experienced declines due to water diversion and human disturbance since the 1970s, the Gunnison Island breeding population has increased slightly during this time (Parrish et al 2002)

Frontier did not find any definitive studies on the effects of landfills on gull predation in the Great Salt Lake Several authors agree that site specific studies should be conducted to determine the effects of landfills on gull populations and their impact to nesting waterfowl and shorebirds because of unique characteristics of individual landfills and the biotic communities they potentially impact (Belant et al 1995, Belant et al 1993) Frontier attempted to summarize readily available literature on the use of landfills by gulls and the impact gull predation has on waterfowl and shorebird species, specifically the American white pelican The conclusions presented in this report are intended to serve as a general guide for land management decisions on Promontory Point and should not be considered an authoritative study on the subject

ARE GULLS ATTRACTED TO LANDFILLS?

Several studies have documented the attraction of various species of gull to landfills in North America and Europe (Belant et al 1988, Belant et al 1995, Belant et al 1993, Patton 1988, Harris 1970) The available literature included observations on ring-billed gulls (*Larus delawarensis*), herring gulls (*L argentatus*), laughing gulls (*L atricilla*), lesser black-backed gulls (*L fuscus*), and California gulls (*L californicus*) Belant et al (1995) reported that gulls comprised 94 5% of the birds recorded at landfills in northern Ohio Patton (1988), observed over 90,000 gulls foraging at seven Tampa Bay area landfills during January and February Similarly, 91% of all birds recorded at a landfill in Cuyahoga County, Ohio, were gulls (Gabrey 1997)

Gulls may be attracted to landfills because they provide a constant food source In many studies, food items found at landfills constituted a substantial component of gull diets Belant (1998) reported that anthropogenic food items comprised 71% of food items collected at a herring gull colony in Ohio The majority of those items were chicken parts In the same study, 54% of food items from ring-billed gull pellets were anthropogenic in origin Again, chicken parts were the primary item detected Anthropogenic food items were the second most common food item found in gull chick boli (partially digested food material) (11%) and in food remains found at nest sites (17%) in Ohio (Belant et al 1995) Items such as beans, strawberries, melons, corn, paper, cloth, and matches were found in the stomachs of gulls in California (Anderson 1965) Landfills may be used for activities other than foraging Belant et al (1993) noted that 62% of gull activity at landfills included loafing, alert posturing, and maintenance activities Therefore, landfills seem to provide habitat for foraging as well as opportunities for social interactions although the primary attractant for gulls to visit landfills is probably foraging opportunities

Use of landfills by gulls may vary seasonally Seasonal changes in abundance of gulls at landfills may be related to migratory patterns For example, gull numbers were five times greater in January and February at a Tampa Bay, Florida, landfill which coincides with their traditional migration patterns (Patton 1988

Seasonal use may be influenced by energetic requirements of nesting and chick-rearing adults Use of landfills, in Cuyahoga County, Ohio, by adult herring gulls increased during the post-fledgling period (Belant et al 1998) Herring gulls in this study used food resources, primarily fish, in Lake Erie almost exclusively during incubation, probably because fish is a higher quality food. Conversely, ring-billed gulls in this study maintained their use of landfills during incubation, chick-rearing, and post-fledgling, probably because they are more general in their food selection (Belant et al 1998) Belant et al (1995) also noted a decrease in herring gull attendance at Ohio landfills, near Lake Erie, during the breeding season and attributed that to an increased diet of fish during that time Belant et al (1993) also noted that herring gulls primarily eat fish during incubation and chick-rearing, but switch to anthropogenic foods during post-fledgling Conversely, Pons (1992) reported that 71% of marked herring gulls used a landfill during incubation and chick-rearing These results suggest that landfills may provide an easily obtainable, nutritionally adequate food source after the breeding season for some species, while providing a constant source of suitable food for other species throughout the breeding season In addition, landfills may not be important food sources for gulls when alternate, high quality food, such as fish, is available The abundance and availability of food items at landfills seem to be important foraging factors

Within a population, gulls of different ages and sexes may exhibit different patterns of landfill use Belant et al (1993) reported that females used landfills more than males The authors suggest that because females are less successful during aggressive foraging, it may be necessary for them to spend more time at landfills to provide an adequate amount of foraging opportunities Belant et al (1993) observed an increase in landfill use by adult and hatching-year gulls following fledgling Patton (1988) reported that first-year laughing gulls were nearly absent from Tampa Bay, Florida landfills in July but comprised 17% of the gulls present from September-February Belant et al (1998) reported that landfill use was similar for adults and hatching-year herring gulls

Landfill use by gulls may be influence by the proximity of the landfill to breeding and nesting sites and by the type of habitat surrounding the facility Belant et al (1995) noted that greater use of some landfills in their study was likely due to their proximity to Lake Erie, a nesting, staging, and wintering area for gulls The authors conclude that increasing the distance of landfills from nesting and staging areas should reduce their use by gulls Conover (1983) reported that many gull colonies in the western United States were located in close proximity to human settlements with associated landfills that provide new food sources Thus, it seems that use of landfills by gulls is influenced by proximity of the landfill to established nesting and staging areas and, in addition, gulls are likely to establish nesting colonies near urban areas and their associated landfills

Gulls have been reported to travel up to 36 km from nesting sites to landfills (Belant et al 1995) Belant (1998) reported that gulls traveled to landfills 23, 26, and 30 km from nesting colonies Gulls in Ohio traveled 19, 28, and 35 km from nesting colonies to feed at landfills Gulls in Florida used landfills 22 km from nighttime roosting sites Conover (1983) reported that 84% of gull colonies were withing 36 km of a town with >1000 people and 40% of colonies were located within 36 km of a town with >10,000 people Conover (1983) surmised that large towns would contain landfills or other anthropogenic food sources

Finally, landfill use is also influenced by management practices Greater numbers of gulls used areas with exposed refuse than areas with recently covered refuse, and they used non-refuse areas the least (Belant et al 1993) Completely incinerated waste buried at landfills appears to be unuseable by gulls (Patton 1988) Gabrey (1997) reported little gull activity at alternative waste-management sites including compost facilities, trash-transfer sites, and a construction and demolition landfill The compost facilities received yard-waste material, the trash-transfer sites received household garbage in small, covered trucks through a garage door where it was unloaded and sorted, the construction and demolition landfill received construction and demolition waste such as cement and soil

PREDATION BY GULLS

Large gulls (*Larus* spp) are opportunistic predators and scavengers who eat a variety of food items including insects, fish, grains, birds, small mammals, eggs, and young birds (Parrish et al 2002, Schmutz et al 2001, Guillemette and Brousseau 2001, Yorio and Quintana 1997, Harris and Wanless 1997, Braun et al 1980, Anderson 1965, and Behle 1935)

Gulls will readily eat the eggs and chicks of other colonial nesting bird species if the opportunity of an unattended egg or chick is present Schmutz et al (2001) reported that gull diets in Alaska include goslings from several species of geese The authors reported a correlation between increased gull numbers and decreased emperor goose gosling survival Braun et al (1980) observed herring gull predation on merganser ducklings Odin determined that 18 3% of duck eggs at Farmington Bay Wildlife Management Area, in Davis County, Utah, were destroyed by California gulls Finally, Parrish et al (2002) report that California gulls are the primary predators of American white pelican young on Gunnison Island

Gulls may limit reproductive success of other colonial nesting bird species Guillemette and Brousseau (2001) reported greater breeding and nesting success of oystercatchers (*Haematopus ostralegus*) during periods of gull culling, indicating that gulls can limit the size of oystercatcher populations Other accounts indicate that gulls are not significant predators of colonial nesting shorebirds and waterfowl Only 2-3 egg predation events during the 1963 nesting season were attributed to gulls in a California study (Anderson 1965)

Predation may be a learned behavior in gulls A study conducted in Patagonia, Argentina, on kelp gulls (*L dominicanus*) and two tern species (*Sterna* spp) reported that predation on tern eggs was restricted to only a few individual gulls at the periphery of the tern colony (Yorio and Quintana 1997) The authors suggest that perhaps certain individuals specialize in this type of feeding behavior They suggest that eliminating those individuals may substantially reduce predation events

PELICANS ON GUNNISON ISLAND

Gunnison Island is located in the Great Salt Lake, approximately 40 km from Promontory Point in Township 9 west, Range 7 north The island is approximately 66 ha in size and contains a great deal of topographic relief and variation including bays, slopes, and sandy beaches American white pelicans and California gulls are the primary colonial nesting species that inhabit the island Because the Great Salt Lake is highly saline and does not support a fishery, both species must travel at least 48 km outside the Great Salt Lake to forage

The only reports of gull predation on American white pelicans that were found were from Gunnison Island (Parrish et al 2002 and Behle 1935) Behle (1935) recounts the observations of Emil Johnson, a local boatman, who observed a reduction in the number of nests with pelican eggs and young after a party of sightseers had been marooned on the island Behle (1935) suggests that " the adult pelicans were kept away from their nests for several hours by the marooned party, thus allowing the gulls to pillage eggs " Parrish et al (2002) reports that California gulls are the primary source of predation to the Gunnison Island pelican colony, especially during disturbances, such as human presence and boat traffic, that leave chicks exposed, away from the nest

Potential for Increased Predation

Based on the results of the literature review, there appears to be little information that would suggest a great potential for increased predation by California gulls on American white pelicans on Gunnison Island from the establishment of a landfill on Promontory Point

Although the landfill would be located within foraging distance from the nesting colony on Gunnison Island, the gull population has access to many high quality foraging areas such as the Bear River Migratory Bird Refuge, state wildlife management areas, the Willard Spur arm of Bear River Bay, and nearby privately managed wetlands (Parish et al 2002)

From the 1920s to 1980, while gull populations across the western United States increased by over 12 times (from 18,210 to 226,000), the population of California gulls on the Great Salt Lake only increased from 41,000 to only 50,000 individuals (Conover 1983) During this time period, the amount of breeding habitat for gulls has increased through the creation of reservoirs In addition, there has been an increase in food resources due to increased human population (and associated landfills) and expanding agricultural practices Despite more productive conditions, the California gull population on the Great Salt Lake has not experienced a great increase in numbers This may be due to other limiting factors, such as the amount of available breeding habitat Because gulls nest on islands, the amount of geographic space available to them for nesting is limited Although development of a landfill at Promontory Point would provide an additional food resource, the California gull population on the Great Salt Lake would likely remain relatively stable because nesting habitat is limited

Finally, the proposed landfill is not expected to increase human disturbance or boat traffic to Gunnison Island or the northern end of the Great Salt Lake Disturbance seems to be the primary reason adult pelicans leave the nest, exposing eggs and chicks to predators By avoiding disturbance, opportunities for predation by California gulls is minimized

Management Recommendations

As stated in a previous section, gulls are less likely to forage at landfills where refuse has been covered (Belant et al 1993) Management practices that minimize the amount of exposed waste will likely reduce gull foraging at landfills However, gulls also used large, open areas with sparse vegetation at landfills for loafing and social interactions (Belant et al 1993) Management practices should take into account the amount of undisturbed habitat available for loafing and other non-foraging activities Additional lethal and non-lethal methods of harassment and control should remain viable under any land management plan to deal with unwanted gull attendance at landfills, especially those located near critical nesting habitat for colonial waterfowl and shorebird species

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RE. Wildlife Concerns - Proposed Promontory Point Landfill

While serving as the Assistant and Acting Leader of the Utah Cooperative Wildlife Research Unit at Utah State University during the 1960's and 1970's, I became well acquainted with Promontory Point One of our students (Fritz Knopf) conducted a study on the nesting colony of white pelicans (Pelicanus erythrorhynchos) on Gunnison Island in the northwest arm of the Great Salt Lake I also have visited Promontory Point on several occasions during recent years - in relation to proposed projects in that area.

It is my understanding that the proposed landfill project area would involve 1,000 acres plus a 1,000-acre buffer area. Also, that at any given time there will be less than 10 acres impacted, and the actual face on the landfill will be approximately 100 feet long. Additionally, the landfill material will be covered daily and will be surrounded by a fence

The proposed project area has relatively very little value for wildlife Fill for the railroad causeway across the north end of the Great Salt Lake was extracted from this area by the Morrison-Knudson Construction Company and it essentially was left as a huge, open pit This rocky area has very little soil and vegetation on it is limited primarily to sparse stands of cheat and galleta grass, with some grease wood at the bottom and a little sagebrush in the upper reaches Furthermore, the area is subject to periodic fires and surface water is virtually absent. In short, it is my professional opinion that it would be difficult to find a suitable area for a landfill that would result in less impact upon wildlife or other environmental values as does the proposed project area

Nesting colonies of gulls and pelicans have co-existed on Gunnison Island (approximately 6 miles to the NW of the proposed project area) for many years With the face of the landfill being only about 100 feet long and the material being covered daily, gull populations should not be significantly increased Activity on the face of the landfill and frequent covering of waste materials should deter much gull activity or feeding on the area Thus, I believe adverse impacts upon the Gunnison Island white pelican rookery (i e from increased gull predation) would be minimal Furthermore, the pelican nesting area is sufficiently isolated and distant from the proposed project area that there should be no negative impacts upon the pelicans from human activities associated with the landfill

It is my understanding that the proposed landfill would not accept any hazardous or chemical wastes. And, four wells would be installed to monitor groundwater within and adjacent to the project area Further, it also is my understanding that municipal wastes will be transported to the site in the same manner in which they are now transported to the landfill areas near Price, Utah, i.e loaded and compacted into box cars by heavy equipment If this is the case, there should be little, if any, contamination or littering of the railroad right-of-way nor of the adjacent Great Salt Lake as a result of the transportation process

If there are any questions with regards to my comments or if I can be of further assistance, please feel free to contact me at (208) 548-2468

Sincerely,

J Juan Spillett

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VITA

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Date & Place of Birth: October 21, 1932, Idaho Falls, Idaho

Secondary Education: Griswold High School, Helix, Oregon
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Collegiate Education & Degrees.
- Utah State University - B S 1961, Wildlife Management
- Central Univ., Quito, Ecuador - Fulbright Scholar 1961-2
- Utah State University - M S 1965, Wildlife Biology
- Johns Hopkins Univ - Sc.D. 1968, Animal Ecology, Animal Behavior & Medical Entomology

Professional Experience:
- Seasonal Naturalist - U S. Park Service (WY, NM & CO) 1958-61
- Asst & Acting Ldr. - Utah Coop Wildlife Research Unit 1967-76
- Assoc Prof - Dept. Wildlife Resources, Utah State Univ 1967-76
- Proj. Ldr. - Int'l Sheep & Goat Inst & Iran Min. Agric 1976-78
- Forest Biologist - Uinta Nat'l Forest, Provo, UT 1978-1980
- Assoc Prof. - Dept Wildlife Science, Texas A&M Univ 1980-82
- Forest Biologist - Caribou Nat'l Forest, Pocatello, ID 1982-90
- Proj Ldr. - Denver WL Research Center (Chad, Africa) 1990-2
- Forest Biologist - Uinto Nat'l Forest, Provo, UT 1992-94

As a Fulbright Scholar in Ecuador, I compiled "A Guide to the Mammals of Ecuador" I then spent 18 months in the Red Desert of WY conducting my M S research on "The Effects of Livestock Fences on Pronghorn Antelope Movements". Thereafter, I spent 2 years in India, during which I conducted my doctoral research on "The Ecology of the Lesser Bandicoot Rat in Calcutta", which was published in book form by the Bombay Natural History Society and the Rockefeller Foundation I also conducted wildlife surveys throughout much of India and in central Nepal under the auspices of the World Wildlife Fund, Morges, Switzerland & The Johns Hopkins Univ I assisted the National Geographic Society with a feature article on "India Strives to Save Her Wildlife" And, I have authored or co-authored more than 100 scientific articles, published in periodicals or journals, i.e. Journal of Wildlife Management, Journal of the Bombay Natural History Society, Journal of Mammalogy, and Journal of Animal Science. I served as editor of the Desert Bighorn Council Transactions for 3 years, and fequently edit contributions to various journals or periodicals

As an Assoc. Prof. in the Depts of Wildlife Science at Utah State and Texas A&M Universities, I taught courses in Principles of Wildlife Mgmt., Wildlife Habitat Mgmt., Wildlife Techniques, and conducted undergraduate and graduate seminars. Most of my time, however, was spent in developing and supervising graduate student research projects More than 30 students received graduate degrees under my supervision Although I retired from federal service in 1994, I serve as an Adjunct Professor at Brigham Young University and the University of Idaho I also have served as a consultant on projects in Bolivia, Honduras, Macedonia and the U S I am particularly interested in working and assisting in projects related to wildlife conservation, i e. the "wise-use" of natural resources

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October 16, 2001

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RE Landfill Development on the Southwest Corner of Promontory

In Reply Please Refer to Case No 01-1596

Dear Mr Workman

The Utah State Historic Preservation Office has reviewed our cultural resource files for the above requested project area No known historic properties have been recorded within the project area because no historic properties' surveys have been conducted

A survey of the area may identify historic properties, some of which may be eligible for the National Register of Historic Places It is your responsibility to determine further actions, such as field surveys, to identify historic properties

This information is provided on request to assist in identifying historic properties, as specified in §36CFR800 for Section 106 consultation procedures If you have questions, please contact me at (801) 533-3555 My email address is jdykman@history state ut us

As ever,

James L Dykmann
Compliance Archaeologist

JLD 01-1596 OR

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June 19, 2003

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Dear Mr Hovey

This letter is written as support and clarification of information contained in the Environmental Assessment prepared for the proposed landfill at Promontory Point Comments in this letter refer to categories listed in **Chapter IV Environmental Consequences**

4 1 6 Wildlife

The numbers and species of wildlife found in this area are very limited because of lack of any surface water Birds are very mobile and as such would not be impacted by this development The variety of small mammals and reptiles that are found in this landfill valley (2,000 acres) are actually widespread in their range on Promontory which includes over 100,000 acres At any given time, less than 25 acres of habitat would be disturbed in the landfill area This would not impact any populations of these species found in the landfill area

State and Federal Agency review of the wildlife and habitat situation at the landfill location was carried out in June of 2003 This involved a field trip with Pam Kramer, Habitat Biologist, Utah Division of Wildlife Resources, and Chris Witt, Biologist, U S Fish and Wildlife Service Both the State and Federal Wildlife Agencies will be sending their comments in writing to Dr Workman for a formal response to the following questions asked by them A review of these issues include the following

1 California gulls and white pelicans

Question Would the landfill attract more gulls to the area which in turn would harm pelican rookeries on Gunnison Island of the Great Salt Lake?

Response Gulls in the vicinity of the proposed landfill would not influence pelican nesting because of the following Gulls are already found on Gunnison Island, the main pelican nesting area Also, there are other gull nesting areas nearby on Egg Island and White Rock in the Great Salt Lake Subsequently, this project should not bring any additional gulls to the Gunnison Island pelican nesting area

In a similar situation on south end of Utah Lake (Goshen Bay), there was a concern that the landfill at Elberta would attract more gulls to their landfill area This did not occur as a small resident population of gulls in that area is all that came to the new landfill area

The main reason for gull populations not increasing in the vicinity of new landfills, is because the area that is open on these landfills at any given time is 1/4 acre or so, and this is covered daily This limited "feeding" area does not attract large numbers of gulls

Question Would the landfill attract more gulls to the area which in turn could impact birds at Bear River Bird Refuge?

Response Bear River Bird Refuge is located over the top of Promontory Mountain to the east, and across Bear River Bay This puts geographical barriers and distance in between the proposed landfill and the Refuge As stated in the response given in the former question, the gull populations will not increase in the vicinity of the proposed landfill as the area that is open on these landfills at any given time is 1/4 acre or so, and this is covered daily

4 1 7 Threatened, Endangered, Candidate or Sensitive Species (of wildlife)

There are no resident species of threatened, endangered, candidate or sensitive species of wildlife found in the vicinity of the proposed landfill Peregrine falcons, golden eagles, and bald eagles are highly mobile and may actually fly across the proposed landfill area However, their habitat is not here but rather in areas such as the Bear River Bird Refuge and marshes on the east side of Promontory There are no resident species of threatened, endangered, candidate or sensitive species of mammals or reptiles that are found on Promontory Point

2 Threatened, Endangered, Candidate or Sensitive Species (of wildlife)

Question Are there any Threatened, Endangered, Candidate or Sensitive Species in the vicinity of the proposed Promontory landfill?

Response In review of research on the flora and fauna of Promontory Point, there were no plants or animals that were categorized as Threatened, Endangered, Candidate or Sensitive on Promontory Point which includes the proposed landfill area

4 1 9 Cultural Resources

Question Are there any archaeological resources that could be destroyed by construction of the proposed landfill Also, is this designated as a special or sacred area by the Shoshoni Indians?

Response This topic is addressed in the Environmental Assessment on the site This query was directed to Mr Bruce Perry, Northwestern Band of the Shoshoni Tribe, Mr James L Dykmann, Compliance Archaeologist, State of Utah, Department of Community and Economic Development, Division of State History, Utah State Historical Society, and Dr Brooke S Arkush, Archaeologist, Department of Sociology and Anthropology, Weber State University

Mr Perry deferred his comments to the State opinion This was also the position of Dr Arkush The State response was

> "The Utah State Historic Preservation Office has reviewed our cultural resource files for the above requested project area No known historic properties have been recorded within the project area because no historic properties' surveys have been conducted "

In the opinion of Mr Ralph Bohn and Mr Carl Wadsworth of the Utah Department of Environmental Quality, Division of Solid and Hazardous Waste, the statement by Mr Dykmann indicates that no artifact evidence has ever been found in the vicinity of the proposed landfill and therefore no surface archaeology inventory is required for the site by the Department of Environmental Quality office for the proposed Promontory Point landfill project

One additional concern that Pam Kramer, Habitat Biologist, Utah Division of Wildlife Resources had related to rehabilitation of the site as each cell or area is filled This will be taken care of by providing soil over the area suitable for planting existing species In this case, the State Division of Natural Resources will be asked to recommend a seed mix for this area that would be suitable for wildlife

If additional information is needed on these subjects in relation to the proposed landfill, please let me know

Sincerely,

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Program Administrator

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Work experience Biologist, Utah Division of Wildlife Resources, Fish and Wildlife Extension Specialist, Federal Extension Service Utah State University, Senior Scientist Utah State University Foundation, Program Administrator, Applied Ecological Services (current)
Publications 200 + publications, including 30 reports (5000+ pages) for the U S Air Force
General studies Research on the prairie dog, ring-tailed cat, beaver, raptors, sharp-tailed grouse, reptiles, various fish, flying squirrels, threatened endangered fish, elk, antelope, bighorn sheep, sheep genetics, gulls, pelicans etc (Other 28 EIS and Assessments)
Air Force studies included research relating to the effect of sonic booms and other disturbances on wildlife including elk bighorn sheep, and antelope Also natural resource management plans, ecological studies on gulls, pelicans, raptors small mammals, threatened and endangered species, and directed research on entomology, outdoor recreation plans, revegetation studies, geology surveys, historical and descriptive studies of Air Force Structures, and archaeological projects
Other research conducted with the Utah Division of Wildlife Resources, Idaho Fish and Game Department, Welder Wildlife Foundation, Bureau of Indian Affairs, National Science Foundation, U S Forest Service, Bureau of Land Management Corps of Engineers, Bureau of Reclamation, National Oceanic and Atmospheric Administration, Atomic Energy Commission, National Park Service, U S Army U S Air Force, and the Government of Cyprus, Red Hawk Land Development, Wendover, Nevada
Positions held President of the Utah Chapter of the Wildlife Society, President of the Bonneville Chapter of the American Fisheries Society President of the Utah Academy of Science, Arts and Letters Director of Bear Lake Laboratory, Vice President of W F Sigler and Associates Inc , Program Administrator of Applied Ecological Services, Inc , Member of Advisory Board of Canyonlands National Park Advisor to National Oceanic and Atmospheric Administration project on the outer continental shelf of Alaska, consultant to various corporations, agencies and utility companies on fisheries, wildlife and other natural and cultural resource projects
Location of projects Alaska, various states in the United States, Mexico, Cyprus

Environmental Consultants

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ENVIRONMENTAL BASELINE REPORT

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Frontier Corporation USA
221 N Spring Creek Parkway, Suite B
Providence, Utah 84332

October 2003

Table of Contents

1 0 INTRODUCTION

Promontory Landfill LLC is proposing to construct and operate a private landfill site at Promontory Point in Box Elder County, Utah The Project Area encompasses approximately 2,006 acres and is located approximately 23 miles west of Ogden on the southwestern side of the Point, immediately north of the existing Union Pacific railroad line (Figure 1) The Project Area covers parts of Sections18, 19, and 30 in T6N, R5W, and Sections 13, 14, 23, 24, and 25 in T6N, R6W (Figure 2) The Project Area is intended to be used as a regional landfill for municipalities in northern Utah It will include a 1,000-acre Disposal Area for municipal waste and a 1,006-acre Buffer Area for wildlife habitat conservation

Promontory Landfill LLC prepared an initial environmental report for the proposed landfill project The initial report was reviewed by the U S Fish and Wildlife Service (USFWS) and the Utah Division of Wildlife Resources (UDWR) In response to potential issues identified by the USFWS and UDWR, Frontier Corporation USA was retained to conduct a baseline inventory of existing habitat types and wildlife conditions within the Project Area The purpose of the baseline inventory was to identify and map habitat types, and to assess habitat values for various wildlife

1 1 Site Description

The Project Area is located on the southern point of the Promontory Mountain Range The Promontory mountains form a narrow peninsula that extends into the northcentral portion of the Great Salt Lake

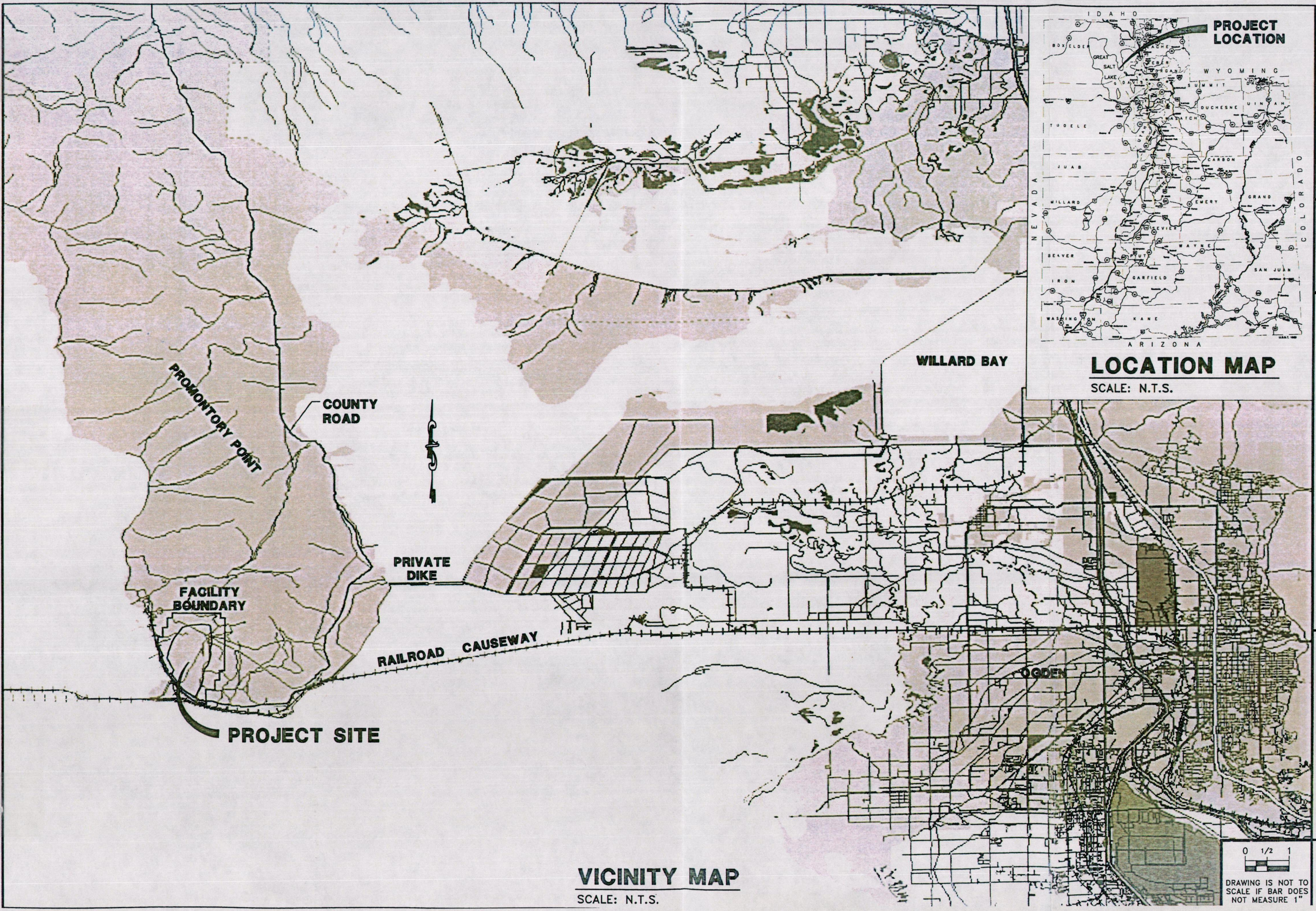
The entire Project Area is located on private property Surrounding properties are also privately owned The Project Area is bounded by steep, rocky terrain on the north, east, and west, and by the Union Pacific Railroad to the south The elevation of the Project Area varies between 4,220 and 5,200 feet above sea level The general slope of the Project Area is from north to south, and it has two primary drainages

The Project Area is comprised of semiarid grassland and rock outcrops Certain areas have been recently disced to create linear firebreaks The disced areas have been cleared of grass and sagebrush at a width of approximately 15 feet The disced areas appear to be situated along the eastern boundary of the Project Area and along a fence line in the northern portion of the Project Area The disced areas have been seeded with wild sunflower (*Helianthus annuus*)

2 0 METHODS

The Project Area was visited on three separate occasions in August and September 2003 A wildlife biologist and a wetlands ecologist conducted

- General habitat mapping,
- An assessment for the presence of wetlands and other water-related features,
- Raptor and migratory bird surveys, and



DESIGN: CAH
DRAWN: TWE
CHECKED: CAH
SCALE: HORZ. AS SHOWN VERT. NONE
DATE: SEPT. 2003

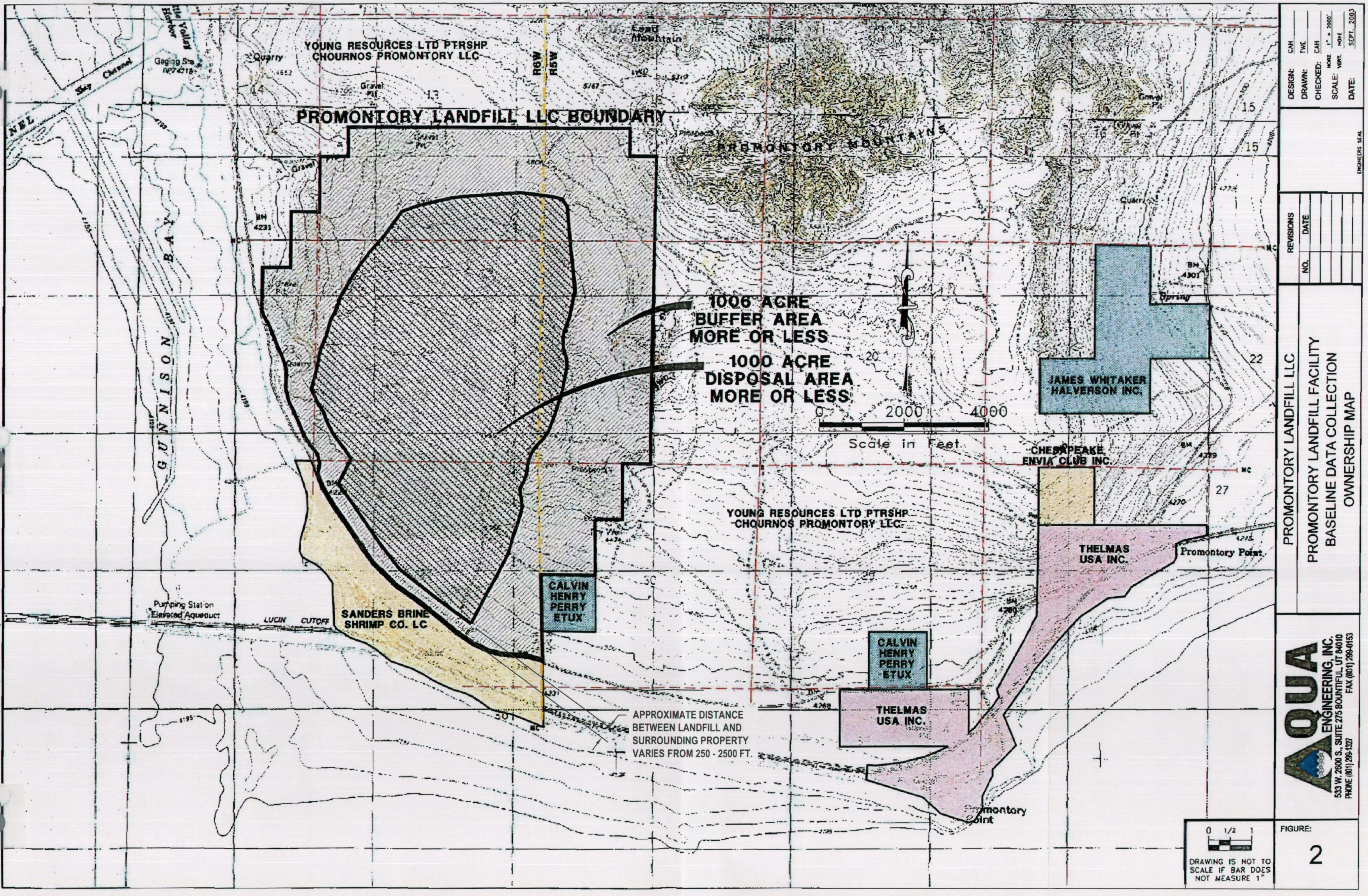
REVISIONS	
NO.	DATE

PROMONTORY LANDFILL LLC

PROMONTORY LANDFILL FACILITY
BASELINE DATA COLLECTION
VICINITY MAP

AQUA ENGINEERING, INC.
533 W. 2600 S., SUITE 275 BOUNTIFUL, UT 84010
PHONE (801) 299-1327 FAX (801) 299-0153

FIGURE: 1



PROMONTORY LANDFILL LLC BOUNDARY
YOUNG RESOURCES LTD PTRSHP
CHOURNOS PROMONTORY LLC
PROMONTORY MOUNTAINS
GUNNISON BAY
1006 ACRE BUFFER AREA MORE OR LESS
1000 ACRE DISPOSAL AREA MORE OR LESS
0 2000 4000
Scale in Feet
JAMES WHITAKER HALVERSON INC.
CHESAPEAKE ENVIA CLUB INC.
YOUNG RESOURCES LTD PTRSHP
CHOURNOS PROMONTORY LLC
THELMAS USA INC.
Promontory Point
CALVIN HENRY PERRY ETUX
SANDERS BRINE SHRIMP CO. LC
CALVIN HENRY PERRY ETUX
THELMAS USA INC.
Pumping Station
Elevated Aqueduct
LUCIN CUTOFF
APPROXIMATE DISTANCE BETWEEN LANDFILL AND SURROUNDING PROPERTY VARIES FROM 250 - 2500 FT.
R6W
R5W
Quarry
Gravel Pit
Spring
Promontory Point
DESIGN: CAH
DRAWN: TWE
CHECKED: CAH
SCALE: 1" = 2000'
DATE: SEPT. 2003
ENGINEERS SEAL
REVISIONS
NO. DATE
PROMONTORY LANDFILL LLC
PROMONTORY LANDFILL FACILITY
BASELINE DATA COLLECTION
OWNERSHIP MAP
AQUA ENGINEERING, INC.
533 W. 2600 S., SUITE 275 BOUNTIFUL, UT 84010
PHONE (801) 299-1327 FAX (801) 299-0153
FIGURE:
2
DRAWING IS NOT TO SCALE IF BAR DOES NOT MEASURE 1"
REVISED BY SHOSHONE ENVIRONMENTAL 10-7-09

- General wildlife observations

The Project Area was inventoried by walking or driving transects where roads were available In addition, the two major drainages were walked and cliff and rock outcrops were glassed with binoculars and spotting scopes for nests and wildlife activity During the field inspections, the approximate locations of habitat boundaries were hand-drawn onto copies of aerial photography Aqua Engineering digitized the habitat mapping and incorporated it into the Project's AUTOCAD database to estimate acreages and to produce maps

3 0 HABITAT CLASSIFICATION

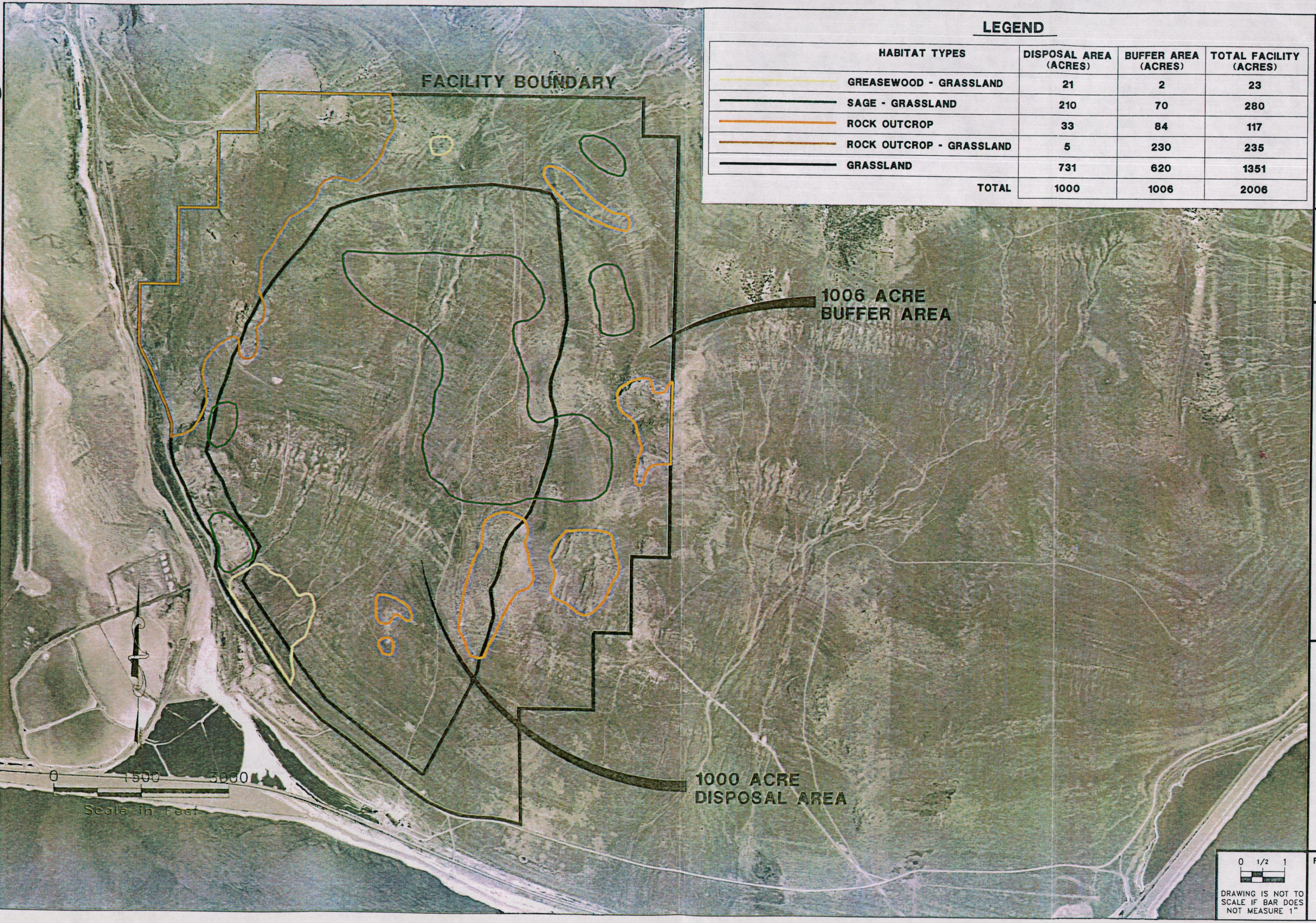
The Project Area is a very rocky site with mostly semiarid grassland dominated by Idaho fescue (*Festuca idahoensis*) and cheatgrass (*Bromus tectorum*) Areas with substantial rock outcrops, sagebrush (*Artemesia tridentata*), or greasewood (*Sarcobatus vermiculatus*) cover were delineated separately (Figure 3) An itemization of habitat acreages that were delineated within the Disposal Area and Buffer Area are shown in Table 1 below

Table 1 Acreages of habitat types delineated at the Promontory Landfill Project Area

Habitat Types	Disposal Area (Acres)	Buffer Area (Acres)	Total Facility (Acres)
Grassland	731	620	1,351
Sagebrush/Grassland	210	70	280
Greasewood/Grassland	21	2	23
Rock Outcrop/Grassland	5	230	235
Rock Outcrop	33	84	117
Total	**1,000**	**1,006**	**2,006**

Vegetative cover is very sparse throughout the Project Area Factors limiting vegetative cover appear to include the rocky geologic nature of the site, the semiarid environment, lack of perennial and/or intermittent water sources, and a long history of heavy grazing pressure by cattle and sheep

The Project Area is an extremely dry site No wetland habitats, stream channels or other jurisdictional waterways were identified within the boundaries of the Project Area No riparian areas, livestock ponds or watering troughs were observed within the Project Area However, there are two deeply incised drainages within the central portion of the Project Area These drainages generally lack channels with defined beds, banks, and ordinary high-water marks These drainages are also discontinuous in several locations and dissipate on the lower terraces within the Project Area without any direct surface connections to the Great Salt Lake



LEGEND

HABITAT TYPES	DISPOSAL AREA (ACRES)	BUFFER AREA (ACRES)	TOTAL FACILITY (ACRES)
GREASEWOOD - GRASSLAND	21	2	23
SAGE - GRASSLAND	210	70	280
ROCK OUTCROP	33	84	117
ROCK OUTCROP - GRASSLAND	5	230	235
GRASSLAND	731	620	1351
TOTAL	1000	1006	2006

DESIGN: CAH
DRAWN: TWE
CHECKED: CAH
SCALE: HORZ. 1" = 1500' VERT. NONE
DATE: SEPT. 2003

ENGINEERS SEAL

REVISIONS	
NO.	DATE

PROMONTORY LANDFILL LLC

PROMONTORY LANDFILL FACILITY
BASELINE DATA COLLECTION
HABITAT DELINEATION

AQUA ENGINEERING, INC.
533 W. 2600 S., SUITE 275 BOUNTIFUL, UT 84010
PHONE (801) 299-1327 FAX (801) 299-0153

0 1/2 1
DRAWING IS NOT TO SCALE IF BAR DOES NOT MEASURE 1"

FIGURE: 3

TWE 10/24/2003 x:\...DRAWING\PROMONTORY\HABITAT\HABITAT BASE.dwg

4 0 WILDLIFE CONDITIONS

Durmg the August-September baselme collection penod, all wildhfe species observed were recorded Any evidence or signs of recent wildhfe use were also recorded A list of wildhfe species observed durmg the surveys is contained in Appendix A
Both direct and indirect observations of wildhfe use were recorded throughout the Project Area Wildlife observations included big game, raptors and other migratory birds, furbearers and small mammals, and reptiles A general description of the wildlife observations are provided below

4 1 Big Game

According to UDWR, the Project Area is considered spring, summer, and autumn habitat for mule deer The Project Area is within the Promontory Point Cooperative Wildlife Management Unit Boundary Very little mule deer sign was observed within the Project Area One grouping of pellets was found on the western portion of the Project Area Five individual deer were observed in the eastern boundary of the buffer area No deer observations or other sign were observed elsewhere in the Project Area

4 2 Game Birds

No game birds were observed in or near the Project Area

4 3 Raptors and Migratory Birds

The Project Area is used by several species of raptors All raptor observations made during the field surveys were recorded Cliffs located on the eastern portion of the Buffer Area provide excellent nesting opportunities for raptors A limited amount of juniper trees also provide nesting opportunities The cliffs and trees were glassed with a spotting scope and binoculars Raptors observed in the Project Area during the surveys included American kestrel , red-tailed hawks, and turkey vultures No nests were observed However, the absence of raptor nesting sites cannot be completely discounted at this time because the baseline study was conducted outside of the nesting season In addition, two burrowing owls were observed utilizing badger digs along the terrace slopes of the main drainages Because the digs did not exhibit long-term use by the owls, it is assumed that these two individuals were probably migrants

4 4 Furbearers and Small Mammals

Coyote sign was not observed in the Project Area, probably as a result of eradication measures for livestock grazing Badger digs were noted along the two main drainages in the Project Area Numerous observations of jackrabbits were observed in the sagebrush/grassland community Numerous small mammal digs were found throughout the gentle sloping areas and drainages in the Project Area

4 5 Reptiles and Amphibians

Few reptiles (small lizards and one horned lizard) were observed No permanent water sources were observed on or near the Project Area No amphibians were observed during the surveys and there appears to be no available habitat present capable of supporting amphibians within the Project Area

5 0 THREATENED, ENDANGERED AND CANDIDATE SPECIES

The USFWS and Utah Division of Wildlife Resources websites provide the federal lists of threatened, endangered and/or candidate species Listed species that may be present within Box Elder County, Utah include

June sucker (*Chasmistes liorus*) - Endangered
Lahontan cutthroat trout (*Oncohynchus clarki henshawi*) - Threatened
Bald eagle (*Haliaeetus leucocephalus*) - Threatened
Fat-whorled pondsnail (*Stagnicola bonnevillensis*) - Candidate
Yellow-billed cuckoo (*Coccyzus americanus*) - Candidate,

There are no perennial streams, ponds, wetland complexes or other permanent water bodies within the Project Area Therefore, there is no habitat within the Project Area for the fat-whorled pondsnail, June sucker or Lahontan cutthroat trout In addition, there are no drainages with large riparian trees (cottonwoods, willows, boxelder) that would provide the habitat requirements for yellow-billed cuckoo

Bald eagles frequent open bodies of water to forage on fish and waterfowl, although they will also forage on carrion Bald eagle nests are usually built in large trees Although it is possible that a migratory eagle may occasionally visit the Project Area, the absence of fish-bearing waterbodies, waterfowl habitat and large trees within or near the Project Area probably preclude the regular usage of the area by bald eagle

APPENDIX A

WILDLIFE SPECIES OBSERVED DURING AUGUST & SEPTEMBER 2003 SURVEYS

PROMONTORY POINT LANDFILL PROJECT AREA BOX ELDER COUNTY, UTAH

BIRDS

Species	**Habitat, Comments**
Turkey vulture (*Cathartes aura*)	Several birds observed over Project Area
Red-tailed hawk (*Buteo jamaicensis*)	Three individuals observed flying in the eastern portion
Mourning dove (*Zenaida macrovra*)	Two bird flushed from drainage, central Project Area
Common raven (*Covus corax*)	Several individuals observed flying over area
Shrike species (*Lanius* spp)	Several individuals observed in sagebrush
Sage sparrow (*Amphispiza belli*)	Several observed in sagebrush
American kestral (*Falco sparverius*)	One individual observed in western portion
Burrowing owl (*Athene cunicularia*)	Two individuals observed in drainages
Cliff swallow (*Hirundo pyrrhonota*)	Several individuals observed in southern portion
Western meadow lark (*Sturnella neglecta*)	Several individuals observed in area

MAMMALS

Species	Habitat, Comments
Mule Deer (*Odocoileus hemionus*)	One pellet groups in northwestern portion, 5 individuals observed in eastern portion of the buffer zone
Badger (*Taxidea taxus*)	Numerous digs on drainage side slopes
Kangaroo rat (*Dipodomys* spp)	Numerous burrows throughout Project Area

REPTILES

Species	Habitat, Comments
Side blotched lizard (*Uta stansburiana*)	Several individuals observed in sage areas
Desert horned lizard (*Phrynosoma platyrhinos*)	One individual observed in southwest portion

APPENDIX G
LINER AND COMPONENT SPECIFICATIONS

Pre-Construction Meeting Agenda

Promontory Landfill Construction
Contract No

Date Time Location

1 **Introductions**
- Name, Company
- Please make sure that everyone has signed the attendance list

2 **Description of Project**
- This project consists of

Contractor ______________________
Total Contract Amount $______________
Contract Calendar Days _____ Days

3 **Important Dates**
- Project Award,
- Execution,
- **Notice to Proceed,**
- First Chargeable Contract Day will be ____________________,
- Contractor's anticipated start date ______________

4 **Delineation of Lines of Authority**
<u>NWB Shoshone</u>

• Engineer/Project Manager	Phone	Cell
• Project Administrator	Phone	Cell
• Inspector(s)	Phone	Cell
• Office Specialist	Phone	Cell

<u>Contractor</u>
- Project Manager
- Superintendent
- QC Manager
- Emergency Phone Numbers (Day and Night)

5 **Utilities**
- Utility company
  - Status of each utility
  - Point of contact and phone number

6 **Errors or Omissions in the Plans**
- Any errors or omissions noted by the contractor

7 **Review of Plans and special requirements**

8 Erosion Control and SW Pollution Prevention Plan

9 Special Project Requirements

10 Subletting Work/Rental Agreements/Purchase Orders/Letters of Entry

- List of subcontractors
- Procedures for Rental Agreements/Purchase Orders

11 Construction Schedule / Progress Chart Submittals

- Submit schedule to the engineer within 30 calendar days after execution of the contract
- Provide updated schedules at the progress meetings on monthly cutoff dates
- Provide two week look ahead schedules at the progress meetings

12 Requested Documentation from Contractor

- The following documentation needs to be submitted
  - ☐ Schedule(s)
  - ☐ List of subcontractors
  - ☐ Emergency phone list
  - ☐ Quality Control Plan
  - ☐ List of officer or director within your company that has the authority to bind your company

13 Handouts to Contractor

14 Progress Meetings

- Agreed upon date, time and location

15 Emergency Evacuation Plan

- In case of an emergency affecting the project, there will need to be a plan to secure the project, list responsibilities, etc

NWB Shoshone Weekly Progress Meeting Report

Ph
Fax

Date

Weather **Temperature (Low/High)**

Project Promontory Landfill
Sunny ___ Cloudy ___ Rain ___ Snow ___ Wind
partly

Contractor

Contr Rep

Deliveries or Returns (Description, From Whom, To Sub)

Schedule Issues

Equipment	**Co**	**Hrs**

Safety Meetings/Injuries

Differing Site Conditions

Work Accomplished This Week

Workforce	**#Men**	**#Hrs**(ea)	**Description**

Comments

Meetings

Telephone Conversations

Visitors

Comments

Superintendent's Signature **(Name)**

Sample Soil Testing Forms

[redacted]
578 E 770 N
[redacted]

January 4,2010
Nuclear Densities
ASTM D 2922 & D 3017
AASHTO T310

PROJECT# [redacted]
PROJECT [redacted]
MATERIAL Brown Sand with Gravel
SOURCE Native
GAUGE 31179 MODEL 3440
CALIBRATION DATE 01/13/2009 STD COUNTS MS 715 DS 2620
LOCATION [redacted]
ITEM
PROCTOR LAB # 177333 PROVIDED BY CMT

LAB NUMBER 184263
DATE TESTED 10/02/2009
SPEC COMPACTION 96 0
TECH J Garcia
AVERAGE DENSITY 96 9

	DEPTH	WET DENS P C F	DRY DENS P C.F	PERCENT MOISTURE CONTENT	PROCTOR MAX DENS P C F	PERCENT OPTIMUM MOISTURE	PERCENT COMPACTION	PASS / FAIL
1	6	125 8	121 8	3 4	124 6	10 0	97 8	PASS
2	6	123 8	119 7	3 4	124 6	10 0	96 1	PASS
3	AVG	124 8	120 7	3 4	124 6	10 0	96 9	PASS
4								
5								
6								
7								
8								
9								
10								

APPROXIMATE LOCATION AND ELEVATION

1 Station 77+79 8 Right of Centerline Top of Sub Grade
2 Station 77+79 8 Right of Centerline Top of Sub Grade
3 Average of #1 and #2
4 CMT Proctor Lab# 177333
5
6
7
8
9
10

Comments

Manager

CMT ENGINEERING LABORATORIES

Construction Materials Technologies
Geotechnical Environmental & Materials Engineering/Testing/Research

December 17 2009

LABORATORY COMPACTION
CHARACTERISTICS OF SOIL
Test Method AASHTO T 180

Customer
Project
Lab No 194363 Project No 3803 Date Tested December 17 2009
Location
Source
Description of Material UTBC

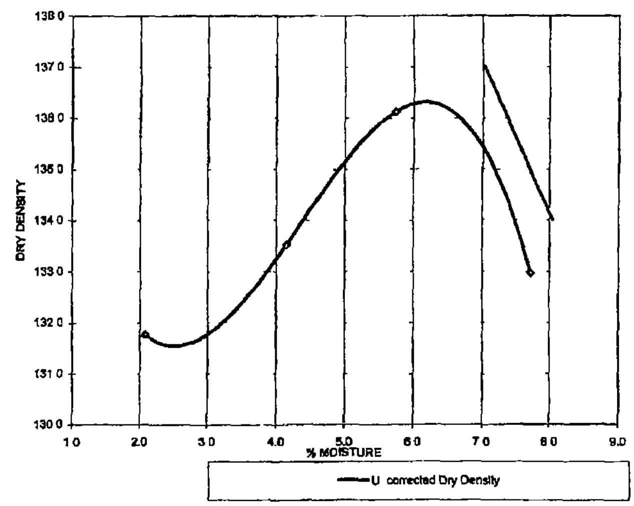
Method	D	**Rock Corrected Proctor Test Results**		
Oversize Correction	Y		Maximum Density	139 5
			Optimum Moisture	5 6
Specific Gravity	2 600			

Gradation Lab No

GRADATION

Sie e	% Retained
+3/4	14
+3/8	10
/ε+#4	16
%-#4	60
Total	100

Type of Compaction Rammer Used Automatic
Method of Sample Preparation Used Dry



Manager

Tested By R ch C
CMT Technician

01/04/2010

[redacted]
P O BOX 437
[redacted] UT [redacted]

ASTM C-2172, C-136, C-117
LAB NO 194057
MATERIAL MSE Select Backfill
PIT/PLANT [redacted]

PROJECT [redacted] TEST DATE 12/14/09
IDENTIFICATION S SIDE OF PILE
SPECIFICATION SAMPLE BY BC RUN BY SF
REMARKS
ITEM

SIEVE USA-METRIC	GRAMS RETAINED	% RETAINED	ACCUM % RETAINED	% PASSING	SPECIFICATION % PASSING
4	0 0	0 0	0 0	100	100
2'	0 0	0 0	0 0	100	
1 5	1420 0	6 5	6 5	94	
1"	3117 2	14 3	20 9	79	
3/4	1805 8	8 3	29 2	71	
1/2	2355 6	10 8	40 0	60	
3/8'	1022 8	4 7	44 7	55	
#4	2112 5	9 7	54 4	46	
- #4	9909 0	45 6			
TOTAL	21742 9				
#10	122 7	12 5	12 5	40	
#16	62 6	6 4	18 9	37	
#40	83 1	8 5	27 3	33	0-60
#100	105 0	10 7	38 0	28	
#200	148 3	15 1	53 1	21 4	0-15

FINE GRADING ONLY
ORIGINAL WT 982 7
WASHED WT 556 6
-#200 W O 426 1
-#200 S O 34 7
TOTAL -#200/75 460 8 = 46 9%

L L 23 0
P I 17 0
P I 6 0
CLASS

ATTERBERG LIMITS AND SOILS CLASSIFICATION

Manager

CMT ENGINEERING LABORATORIES

SANDCONE DENSITY
AASHTO T 191

January 4 2010

Project

Project No | Lab No 163788 | Date Tested May 29 2009

Location

Sample ID 2205290833

Material Description Lt brown silty gravel w/ sand

GROUND SURFACE CALIBRATION				CALIBRATION OF DENSITY SAND		
A.	CONTAINER NUMBER	#1	LBS	1 WT OF SAND + TARE		LBS
B	WT INITIAL CONTAINER + SAND		LBS	2 WT OF TARE		LBS
C	WT AFTER CONTAINER + SAND		LBS	3 WT OF SAND + TARE		LBS
D	WT SAND (B C) USE FOR K		LBS	4 VOL OF CONTAINER		CU-FT
				5 WT CU-FT OF SAND (3/		LBS

DENSITY DETERMINATION			
E	WET SAMPLE + CONTAINER	12 46	LBS
F	WT CONTAINER	0	LBS
G	WT WET SAMPLE (E F)	12 46	LBS
H.	SAND +CONTAINER START (FROM C)	13 845	LBS
I	SAND +CONTAINER FINISH	3 29	LBS
J	SAND IN HOLE + CONE (H-I)	10 555	LBS
K	SAND IN LOWER CONE + PLATE (I	3.327	LBS
L	SAND IN HOLE ONLY (J K)	7 228	LBS
M	DENSITY OF SAND	83 4	LBS
N	VOLUME OF HOLE (L/M)	0 0867	CU FT
P	UNIT WET WT SAMPLE (G/N)	143 8	LBS/CU FT
R	UNIT DRY WT SAMPLE (P/100+Y)	138 5	LBS/CU FT

COMPARISON OF FIELD DENSITY TO PROCTOR				
6	SEE PROCTOR LAB NUMBER		163787	
7	MAXIMUM DENSITY		143 2	LB/CUFT
8	DEGREE OF COMPACTION (R /7)		96 8	%
9	COMPACTION REQUIRED			%
10	OPTIMUM MOISTURE		5 4	%
11	AMT RETAINED ON #4	LBS		%
12	AMT RETAINED ON 3/4	LBS		%
13	TOTAL WT	LBS	100	%

ROCK CORRECTION			
AA	WT IN AIR (SAT SUR DRY)		GMS
BB	WT IN WATER		GMS
CC	VOL ROCK (AA BB /28 306)		CU FT
DD	CORRECTED WT SAMPLE (G AA/453 6)		LBS
EE	CORRECTED VOL. HOLE (L/M-CC)		CU FT
FF	CORR UNIT WT SAMPLE (DD/EE		LBS/ CU-FT

MOISTURE CONTENT			
S	CONTAINER NUMBER	1	
T	WT MOIST SAMPLE + CONTAINER	6466 3	GRAMS
U	WT DRY SAMPLE + CONTAINER	6261 1	GRAMS
V	WT OF WATER (T U)	205 20	GRAMS
W	WT OF CONTAINER	814 3	GRAMS
X	WT OF DRY SAMPLE (U W)	5446 8	GRAMS
Y	PERCENT MOISTURE (V/X)	3 77	PERCENT

TESTED BY Client

CHECKED BY Susan Arnold

SUBMITTED BY Susan Arnold

January 4, 2010

Customer Name
Customer Address
City, State Zip

Project Project Number and/or Name
I D
Lab # 12345

PERMEABILITY TEST BY BACK PRESSURE
CONSTANT HEAD
ASTM D-5084

	Initial	**Final**	
Density pcf	134 8	144 5	
Height in	2 241	2 194	5 573 cm
Diameter in	2 730	2 695	
Area in^2	5 851	5 701	36 629 cm^2
Volume cc	215 04	205 14	

Height change -0 047
Volume change 23 2
Cell change 13 3 @ 70 PSI
Net volume change -9 9
h = T/B Press diff 3 0 210 30 cm
Standard Water 005N $CaSO_4$
Hydraulic Gradient 37 74

Elapsed Time min	cc	K cm/sec
5 5	0 6	1 96 E-05
8 5	0 5	2 11 E-05
19 5	0 5	1 94 E-05
6 5	1 0	1 94 E-05

K AVERAGE = 1 99 x 10^{5} cm/s

MANAGFR

4

ASTM D2216 – Moisture Content Worksheet

Date ______________________ Lab Number(s) ______________________

Project Number ______________ Client ____________________

Project ______________________

Product ______________________

Elevation ____

Test Results

D 2216 – Moisture Content			
	Formula	Description	Test Data
	—	Pan No	
D	—	Wet Weight With Pan	
E	—	Dry Weight With Pan	
F	D – E	Water Weight	
G	–	Empty Pan Weight	
H	E – G	Dry Aggregate Weight	
	$\frac{F}{H} \times 100$	Percent Moisture	

GEOSYNTHETIC CLAY LINER (GCL)

SECTION 2343

GEOSYNTHETIC CLAY LINER (GCL)

PART 1 – GENERAL

1 01 Scope

This specification covers the technical requirements for the furnishing and installation of the geosynthetic clay liner described herein All matenals used shall meet the requirements of this specification, and all work shall be performed in accordance with the procedures provided herein and the contract drawings

1 02 Definitions

For the purposes of this specification guideline, the following terms are defined below

Geosynthetic Clay Liner (GCL) A manufactured hydraulic barner consisting of clay bonded to a layer or layers of geosynthetics

Geomembrane An essentially impermeable geosynthetic composed of one or more geosynthetic sheets

Geotextile Any permeable geosynthetic compnsed solely of textiles

Minimum Average Roll Value For geosynthetics, the value calculated as the typical value minus two (2) standard deviations from documented quality control test results for a defined population from one specific test method associated with one specific property

Overlap Where two adjacent GCL panels contact, the distance measunng perpendicular from the overlying edge of one panel to the underlying edge of the other

Typical Value The mean value calculated from documented manufacturing quality control test results for a defined population obtained from one test method associated with one specific property

1 03 Unit Pnces

Measurement will be made of the total surface area in square feet covered, as measured parallel to the liner surface, including designed anchor trench matenal as shown on the contract drawings Final quantities will be based on as-built conditions No allowance will be made for waste, overlap, or materials used for the convenience of the Contractor GCL installed and accepted will be paid for at the respective contract unit price in the bidding schedule

1 04 Submittals

A The Contractor shall furnish the following information

1 Conceptual descnption of the proposed plan for placement of the GCL panels over the area of installation
2 GCL manufacturer's MQC Plan for documenting compliance to Sections 2 1 and 2 2 of these specifications

3 GCL manufacturer's historical data for reinforced GCL from 10,000-hour creep shear testing per Section 2 1 D

B At the Engineer's or Owner's request the Contractor shall furnish

1 A representative sample of the GCLs
2 A project reference list for the GCL(s) consisting of the principal details of projects totaling at least 1 million square feet in size

C Upon shipment, the Contractor shall furnish the GCL manufacturer's Quality Assurance/Quality Control (QA/QC) certifications to verify that the materials supplied for the project are in accordance with the requirements of this specification

D As installation proceeds, the Contractor shall submit certificates of subgrade acceptance, signed by the Contractor and QA Inspector (see Section 1 7) for each area that is covered by the GCL

1 05 Qualifications

A GCL Manufacturer must have produced at least 10 million square feet (1 million square meters) of GCL, with at least 8 million square feet (800,000 square meters) installed

B The GCL Installer must either have installed at least 1 million square feet (100,000 square meters) of GCL, **or** must provide to the Engineer satisfactory evidence, through similar experience in the installation of other types of geosynthetics, that the GCL will be installed in a competent, professional manner

1 06 Quality Assurance (QA)

A The Contractor shall provide a QA Officer for inspection of the GCL installation The QA Officer shall be an individual or company who is independent from the manufacturer and installer, who shall be responsible for monitoring and documenting activities, related to the QA of the GCL, throughout installation

B Testing of the GCL, as necessary to support the QA effort, shall be performed by a third party laboratory retained by the Contractor and independent from the GCL manufacturer and installer

C QA shall be provided in accordance with the *GCL QA Manual* provided by the Manufacturer

PART 2 – PRODUCTS

A The GCLs shall consist of a layer of natural sodium bentonite clay encapsulated between two geotextiles and shall comply with all of the criteria listed in this Section Prior to using an alternate GCL, the Contractor must furnish independent test results demonstrating that the proposed alternate material meets all requirements of this specification The Contractor also must obtain prior approval of the alternative GCL by the Project Engineer

B Reinforced GCL must be used on slopes as designated by the Engineer

2 01 Materials

A Acceptable reinforced GCL products are Bentomat® ST, as manufactured by CETCO, 1500 West Shure Drive, Arlington Heights, Illinois 60004 USA (847-392-5800), or an engineer-approved equal

B Areas requiring reinforced GCL will be furnished with Bentomat® ST or an engineer-approved equal The delineation of these areas shall be agreed by the Installer and the Engineer prior to installation

C The reinforced GCL and its components shall have the properties shown in Table TR404-st

D The reinforced GCL shall have 10,000 hour test data for large-scale constant-load (creep) shear testing under hydrated conditions The constant shear load shall be 0 56 kN and the normal load shall be 1 1 kN

E The minimum acceptable dimensions of full-size GCL panels shall be 150 feet (45 7 m) in length Short rolls [(those manufactured to a length greater than 70 feet (21 m) but less than a full-length roll)] may be supplied at a rate no greater than 3 per truckload or 3 rolls every 36,000 square feet (3,500 square meters) of GCL, whichever is less

F A 6-inch (150 mm) overlap guideline shall be impnnted on both edges of the upper geotextile component of the GCL as a means for providing quality assurance of the overlap dimension Lines shall be pnnted in easily visible, non-toxic ink

2 02 Product Quality Documentation

The GCL manufacturer shall provide the Contractor or other designated party with manufactunng QA/QC certifications for each shipment of GCL The certifications shall be signed by a responsible party employed by the GCL manufacturer and shall include

A Certificates of analysis for the bentonite clay used in GCL production demonstrating compliance with the parameters swell index and fluid loss shown in tables TR404-st and TR404-200r

B Manufacturer's test data for finished GCL product(s) of bentonite mass/area, GCL tensile strength and GCL peel strength (reinforced only) demonstrating compliance with the index parameters shown in tablesTR404-st and/or TR404-200r

C GCL lot and roll numbers supplied for the project (with corresponding shipping information)

Manufacturer's test data for finished GCL product(s) including GCL index flux, permeability and hydrated internal shear strength data demonstrating compliance with the performance parameters shown in table TR404-st

TABLE TR-404ST
Bentomat ST / Reinforced GCL

MATERIAL PROPERTY	TEST METHOD	TEST FREQUENCY, ft2 (m2)	REQUIRED VALUES
Bentonite Swell Index[1]	ASTM D 5890	1 per 50 tonnes	24 mL/2g min
Bentonite Fluid Loss[1]	ASTM D 5891	1 per 50 tonnes	18 mL max
Bentonite Mass/Area[2]	ASTM D 5993	40,000 ft^2 (4,000 m^2)	0 75 lb/ft^2 (3 6 kg/m^2)
GCL Grab Strength[3]	ASTM D 4632	200,000 ft^2 (20,000 m^2)	90 lbs (400 N)
GCL Peel Strength[3]	ASTM D 4632	40,000 ft^2 (4,000 m^2)	15 lbs (65 N)
GCL Index Flux[4]	ASTM D 5887	Weekly	1×10^{8} $m^3/m^2/sec$
GCL Permeability[4]	ASTM D 5887	Weekly	5×10^{9} cm/sec
GCL Hydrated Internal Shear Strength[5]	ASTM D 5321	Periodic	500 psf (24 kPa) typical

Bentomat "ST" is a reinforced GCL consisting of a layer of sodium bentonite between a woven and a non-woven geotextile, which are needlepunched together

Notes

1 *Bentonite property tests performed at CETCO's bentonite processing facility before shipment to CETCO's GCL production facilities*

2 *Bentonite mass/area reported at 0 percent moisture content*

3 *All tensile testing is performed in the machine direction, with results as minimum average roll values unless otherwise indicated*

4 *Index flux and permeability testing with deaired distilled/deionized water at 80-psi (551 kPa) cell pressure, 77 psi (531 kPa) headwater pressure and 75 psi (517 kPa) tailwater pressure Reported value is equivalent to 925 gal/acre/day This flux value is equivalent to a permeability of 5x10^{9} cm/sec for typical GCL thickness This flux value should not be used for equivalency calculations unless the gradients used represent field conditions A flux test using gradients that represent field conditions must be performed to determine equivalency The last 20 weekly values prior the end of the production date of the supplied GCL may be provided*

5 *Peak value measured at 200-psf (30 kPa) normal stress Site-specific materials, GCL products, and test conditions must be used to verify internal and interface strength of the proposed design*

2 03 Product Labeling

A Prior to shipment, the GCL manufacturer shall label each roll, identifying

1 Product identification information (Manufacturer's name and address, brand product code)

2 Lot number and roll number

3 Roll length, width and weight

2 04 Packaging

A The GCL shall be wound around a rigid core whose diameter is sufficient to facilitate handling The core is not necessarily intended to support the roll for lifting but should be sufficiently strong to prevent collapse during transit

B All rolls shall be labeled and bagged in packaging that is resistant to photodegradation by ultraviolet (UV) light

2 05 Accessory Bentonite

A The granular bentonite sealing clay used for overlap seaming, penetration sealing and repairs shall be made from the same natural sodium bentonite as used in the GCL and shall be as recommended by the GCL manufacturer Seaming of GCLs shall be conducted in accordance with the manufacturer's guidelines for each particular GCL Please refer to the installation guidelines for Bentomat GCLs

PART 3 – EXECUTION

3 01 Shipping and Handling

A The manufacturer assumes responsibility for initial loading the GCL Shipping will be the responsibility of the party paying the freight Unloading, on-site handling and storage of the GCL are the responsibility of the Contractor, Installer or other designated party

B A visual inspection of each roll should be made during unloading to identify if any packaging has been damaged Rolls with damaged packaging should be marked and set aside for further inspection The packaging should be repaired prior to being placed in storage

C The party responsible for unloading the GCL should contact the Manufacturer prior to shipment to ascertain the appropriateness of the proposed unloading methods and equipment

3 02 Storage

A Storage of the GCL rolls shall be the responsibility of the installer A dedicated storage area shall be selected at the job site that is away from high traffic areas and is level, dry and well drained

B Rolls should be stored in a manner that prevents sliding or rolling from the stacks and may be accomplished by the use of chock blocks Rolls should be stacked at a height no higher than that at which the lifting apparatus can be safely handled (typically no higher than four)

C All stored GCL materials and the accessory bentonite must be covered with a plastic sheet or tarpaulin until their installation

D The integrity and legibility of the labels shall be preserved during storage

3 03 Earthwork

A Any earthen surface upon which the GCL is installed shall be prepared and compacted in accordance with the project specifications and drawings The surface shall be smooth, firm, and unyielding, and free of

1 Vegetation
2 Construction Debris
3 Sticks
4 Sharp rocks
5 Void spaces
6 Ice
7 Abrupt elevation changes
8 Standing water
9 Cracks larger than one-quarter inch (6 mm) in width
10 Any other foreign matter that could contact the GCL

B Subgrade surfaces consisting of granular soils or gravel may not be acceptable due to their large void fraction and puncture potential *In high head applications, such as ponds and wastewater lagoons, subgrade soils should possess a particle size distribution such that at least 80 percent of the soil is finer than a #60 sieve (0 250 mm)*

C Immediately prior to GCL deployment, the subgrade shall be final-graded to fill in all voids or cracks and then smooth-rolled to provide the best practicable surface for the GCL At completion of this activity, no wheel ruts, footprints or other irregularities shall exist in the subgrade Furthermore, all protrusions extending more than one-half inch (12 mm) from the surface shall either be removed, crushed or pushed into the surface with a smooth-drum compactor

D On a continuing basis, the project QA inspector shall certify acceptance of the subgrade before GCL placement

E It shall be the installer's responsibility thereafter to indicate to the Engineer any change in the condition of the subgrade that could cause the subgrade to be out of compliance with any of the requirements listed in this Section

F At the top of sloped areas of the job site, an anchor trench for the GCL shall be excavated or an equivalent runout shall be utilized in accordance with the project plans and specifications and as approved by the QA Inspector When utilizing an anchor trench design, the trench shall be excavated and approved by the QA Inspector prior to GCL placement No loose soil shall be allowed at the bottom of the trench and no sharp corners or protrusions shall exist anywhere within the trench

3 04 GCL Placement

A Unreinforced GCL shall be placed on the flatter areas of the site, reinforced GCL shall be placed on the more steeply sloped areas The Installer and Project engineer shall review and agree upon which GCL shall be placed on these areas prior to installation

B GCL rolls should be delivered to the working area of the site in their original packaging Immediately prior to deployment, the packaging should be carefully removed without damaging the GCL The orientation of the GCL (i e , which side faces up) should be in accordance with the Engineer's recommendations

C Equipment, which could damage the GCL, shall not be allowed to travel directly on it If the installation equipment causes rutting of the subgrade, the subgrade must be restored to its originally accepted condition before placement continues

D Care must be taken to minimize the extent to which the GCL is dragged across the subgrade in order to avoid damage to the bottom surface of the GCL A temporary geosynthetic subgrade covering commonly known as a slip sheet or rub sheet may be used to reduce friction damage during placement

E The GCL panels shall be placed parallel to the direction of the slope

F All GCL panels should lie flat on the underlying surface, with no wrinkles or fold, especially at the exposed edges of the panels

G Only as much GCL shall be deployed as can be covered at the end of the working day with soil, a geomembrane, or a temporary waterproof tarpaulin The GCL shall not be left uncovered overnight If the GCL is hydrated when no confining stress is present, it may be necessary to remove and replace the hydrated material The project Engineer, QA inspector, and GCL supplier should be consulted for specific guidance if premature hydration occurs

3 05 Anchorage

A As directed by the project drawings and specifications, the end of the GCL roll shall be placed in an anchor trench at the top of the slope or an equivalent runout design shall be utilized When utilizing an anchor trench design, the front edge of the trench should be rounded so as to eliminate any sharp corners Loose soil should be removed from the floor of the trench The GCL should cover the entire trench floor but does not extend up the rear trench wall

3 06 Seaming

A The GCL seams are constructed by overlapping their adjacent edges Care should be taken to ensure that the overlap zone is not contaminated with loose soil or other debris Supplemental bentonite is required for reinforced GCL

B The minimum dimension of the longitudinal overlap should be 6 inches (150 mm) End-of-roll overlapped seams should be similarly constructed, but the minimum overlap should measure 24 inches (600 mm)

C Seams at the ends of the panels should be constructed such that they are shingled in the direction of the grade to prevent the potential for runoff flow to enter the overlap zone

D Bentonite-enhanced seams are constructed between the overlapping adjacent panels described above The underlying edge of the longitudinal overlap is exposed and then a continuous bead of granular sodium bentonite is applied along a zone defined by the edge of the underlying panel and the 6-inch (150-mm) line A similar bead of granular sodium bentonite is applied at the end-of-roll overlap The granular bentonite shall be applied at a minimum application rate of one quarter pound per lineal foot (0 4 kg/m) Please refer to the Bentomat/Claymax installation guidelines for the seaming requirements of a particular GCL

3 07 Detail Work

A The GCL shall be sealed around penetrations and embedded structures embedded in accordance with the design drawings and the GCL Manufacturer

B Cutting the GCL should be performed using a sharp utility knife Frequent blade changes are recommended to avoid damage to the geotextile components of the GCL during the cutting process

3 08 Damage Repair

A If the GCL is damaged (torn, punctured, perforated, etc) during installation, it may be possible to repair it by cutting a patch to fit over the damaged area The patch shall be obtained from a new GCL roll and shall be cut to size such that a minimum overlap of 12 inches (300 mm) is achieved around all of the damaged area Granular bentonite or bentonite mastic should be applied around the damaged area prior to placement of the patch It may be desirable to use an adhesive to affix the patch in place so that it is not displaced during cover placement

3 09 Cover Placement

A Cover soils shall be free of angular stones or other foreign matter that could damage the GCL Cover soils should be approved the project Engineer with respect to particle size, uniformity and chemical compatibility Cover soils with high concentrations of calcium (e g , limestone, dolomite) are not acceptable

B Soil cover shall be placed over the GCL using construction equipment that minimizes stresses on the GCL A minimum thickness of 1foot (300 mm) of cover should be maintained between the equipment tires/tracks and the GCL at all times dunng the covenng process This thickness recommendation does not apply to frequently trafficked areas or roadways, for which a minimum thickness of 2 feet (600 mm) is required

Doesn't apply

C Soil cover should be placed in a manner that prevents the soil from entenng the GCL overlap zones Cover soil shall be pushed up slopes, not down slopes, to minimize tensile forces on the GCL

Then it should be removed

D Although direct vehicular contact with the GCL is to be avoided, lightweight, low ground pressure vehicles (such as 4-wheel all-terrain vehicles) may be used to facilitate the installation of any geosynthetic material placed over the GCL The GCL supplier or QA engineer should be contacted with specific recommendations on the appropnate procedures in this situation

E When a textured geomembrane is installed over the GCL, a temporary geosynthetic covenng known as a slip sheet or rub sheet should be used to minimize fnction dunng placement and to allow the textured geomembrane to be more easily moved into its final position

POLYETHYLENE GEOMEMBRANE LINER

SECTION 02342

POLYETHYLENE GEOMEMBRANE LINER

PART 1 – GENERAL

1 01 Section Includes

A Specifications and guidelines for MANUFACTURING and INSTALLING geomembrane

1 02 References

C Amencan Society for Testing and Materials (ASTM)

1 D 1004 Test Method for Initial Tear Resistance of Plastic Film and Sheeting
2 D 1238 Standard Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer
3 D 1505 Test Method for Density of Plastics by the Density-Gradient Technique
4 D 1603 Test Method for Carbon Black in Olefin Plastics
5 D 3895 Standard Test Method for Oxidative-Induction Time of Polyolefins by Differential Scanning Calonmetry
6 D 4833 Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products
7 D 5199 Standard Test Method for Measuring Nominal Thickness of Geotextiles and Geomembranes
8 D 5397 Standard Test Method for Evaluation of Stress Crack Resistance of Polyolefin Geomembranes Using Notched Constant Tensile Load Test
9 D 5596 Standard Test Method for Microscopic Evaluation of the Dispersion of Carbon Black in Polyolefin Geosynthetics
10 D 5994 Standard Test Method for Measuring Core Thickness of Textured Geomembranes
11 D 6392 Standard Test Method for Determining the Integnty of Nonreinforced Geomembrane Seams Produced Using Thermo-Fusion Methods
12 D 6693 Standard Test Method for Determining Tensile Properties of Nonreinforced Polyethylene and Nonreinforced Flexible Polypropylene Geomembranes

C Geosynthetic Research Institute

1 GRI GM 13 Test Properties, Testing Frequency and Recommended Warranty for High Density Polyethylene (HDPE) Smooth and Textured Geomembranes
2 GRI GM 17 Test Properties, Testing Frequency and Recommended Warranty for Linear Low Density Polyethylene (LLDPE) Smooth and Textured Geomembranes

1 03 Definitions

A Lot- A quantity of resin (usually the capacity of one rail car) used in the manufacture of geomembranes Finished roll will be identified by a roll number traceable to the resin lot used

B Construction Quality Assurance Consultant (CONSULTANT) - Party, independent from MANUFACTURER and INSTALLER that is responsible for observing and documenting activities related to quality assurance during the lining system construction

C ENGINEER- The individual or firm responsible for the design and preparation of the project's Contract Drawings and Specifications

D Geomembrane Manufacturer (MANUFACTURER) - The party responsible for manufacturing the geomembrane rolls

E Geosynthetic Quality Assurance Laboratory (TESTING LABORATORY)- Party, independent from the OWNER, MANUFACTURER and INSTALLER, responsible for conducting laboratory tests on samples of geosynthetics obtained at the site or during manufacturing, usually under the direction of the OWNER

F INSTALLER- Party responsible for field handling, transporting, storing, deploying, seaming and testing of the geomembrane seams

G Panel- Unit area of a geomembrane that will be seamed in the field that is larger than 100 ft^2

H Patch- Unit area of a geomembrane that will be seamed in the field that is less than 100 ft^2

I Subgrade Surface- Soil layer surface which immediately underlies the geosynthetic material(s)

1 04 Submittals

A Furnish the following product data, in writing, to ENGINEER prior to installation of the geomembrane material

1 Resin Data shall include the following
   a Certification stating that the resin meets the specification requirements (see Section 1 09)
2 Geomembrane Roll
   a Statement certifying no recycled polymer and no more than 10% rework of the same type of material is added to the resin (product run may be recycled)

B The INSTALLER shall furnish the following information to the ENGINEER and OWNER prior to installation

1 Installation layout drawings
   a Must show proposed panel layout including field seams and details
   b Must be approved prior to installing the geomembrane
      1 Approved drawings will be for concept only and actual panel placement will be determined by site conditions

2 Installer's Geosynthetic Field Installation Quality Assurance Plan

C The INSTALLER will submit the following to the ENGINEER upon completion of installation

1 Certificate stating the geomembrane has been installed in accordance with the Contract Documents
2 Material and installation warranties
3 As-built drawings showing actual geomembrane placement and seams including typical anchor trench detail

1 05 Quality Assurance (QA)

A The Contractor shall provide a QA Officer for inspection of the geomembrane installation The QA Officer shall be an individual or company who is independent from the manufacturer and installer, who shall be responsible for monitoring and documenting activities, related to the QA of the geomembrane, throughout installation

B Testing of the geomembrane, as necessary to support the QA effort, shall be performed by a third party laboratory retained by the Contractor and independent from the geomembrane manufacturer and installer

C QA shall be provided in accordance with the *geomembrane QA Manual* provided by the Manufacturer

1 06 Qualifications

A MANUFACTURER

1 Geomembrane shall be manufactured by the following
   a GSE Lining Technology, Inc
   b approved equal
2 MANUFACTURER shall have manufactured a minimum of 10,000,000 square feet of polyethylene geomembrane during the last year

B INSTALLER

1 Installation shall be performed by one of the following installation companies (or approved equal)
   a GSE Lining Technology, Inc
   b *GSE Approved Dealer/Installers*

2 INSTALLER shall have installed a minimum of 1,000,000 square feet of HDPE

3 The Installation Supervisor shall have worked in a similar capacity on projects similar in size and complexity to the project described in the Contract Documents

4 The INSTALLER shall provide a minimum of one Master Seamer for work on the project

a Must have completed a minimum of 1,000,000 square feet of geomembrane seaming work using the type of seaming apparatus proposed for the use on this Project

1 07 Material Labeling, Delivery, Storage, and Handling

A Labeling - Each roll of geomembrane delivered to the site shall be labeled by the MANUFACTURER The label will identify

a Manufacturer's name
b Product identification
c Thickness
d Length
e Width
f Roll number

B Delivery- Rolls of liner will be prepared to ship by appropriate means to prevent damage to the material and to facilitate off-loading

C Storage- The on-site storage location for geomembrane material, provided by the CONTRACTOR to protect the geomembrane from punctures, abrasions and excessive dirt and moisture for should have the following characteristics

a Level (no wooden pallets)
b Smooth
c Dry
d Protected from theft and vandalism
e Adjacent to the area being lined

D Handling- Materials are to be handled so as to prevent damage

1 08 Warranty

A Material shall be warranted, on a pro-rata basis against Manufacturer's defects for a period of 5 years from the date of geomembrane installation

B Installation shall be warranted against defects in workmanship for a period of 1 year from the date of geomembrane completion

1 09 Geomembrane

A Material shall be smooth/textured polyethylene geomembrane as shown on the drawings

B Resin

1 Resin shall be new, first quality, compounded and manufactured specifically for producing geomembrane

2 Natural resin (without carbon black) shall meet the following minimum requirements

Property	Test Method	HDPE	LLDPE
Density [g/cm^3]	ASTM D 1505	0 932	0 915
Melt Flow Index [g/10 min]	ASTM D 1238 (190/2 16)	≤ 1 0	≤ 1 0
OIT [minutes]	ASTM D 3895 (1 atm/200°C)	100	100

C Geomembrane Rolls

1 Do not exceed a combined maximum total of 1 percent by weight of additives other than carbon black

2 Geomembrane shall be free of holes, pinholes as verified by on-line electrical detection, bubbles, blisters, excessive contamination by foreign matter, and nicks and cuts on roll edges

3 Geomembrane material is to be supplied in roll form Each roll is to be identified with labels indicating roll number, thickness, length, width and MANUFACTURER

4 All liner sheets produced at the factory shall be inspected prior to shipment for compliance with the physical property requirements listed in section 1 09, B, and be tested by an acceptable method of inspecting for pinholes If pinholes are located, identified and indicated during manufactunng, these pinholes may be corrected during installation

D Smooth surfaced geomembrane shall meet the requirements shown in the following table(s) for the following material(s)

1 Table 1 1 for black HDPE

2 Table 1 2 for white-surfaced HDPE
   - a) The geomembrane shall be a white-surfaced, coextruded geomembrane
   - b) The white surface shall be installed upwards

3 Table 1 3 for smooth conductive HDPE
   - a) The geomembrane shall have a coextruded, electrically conductive layer
   - b) The conductive layer is installed downward
   - c) Electrical testing shall be performed after liner installation by the INSTALLER

4 Table 1 4 for black LLDPE

5 Table 1 5 for white-surfaced LLDPE
   - a) The geomembrane shall be a white-surfaced, coextruded geomembrane
   - b) The white surface shall be installed upwards

E Textured surfaced geomembrane shall meet the requirements shown in the following table(s) for the following material(s)

1 Table 2 1 for black coextruded textured HDPE
2 Table 2 2 for white-surfaced coextruded textured HDPE
   a) The geomembrane shall be a white-surfaced, coextruded geomembrane
   b) The white surface shall be installed upwards
3 Table 2 3 for black coextruded textured LLDPE
4 Table 2 4 for white-surfaced coextruded textured LLDPE
   a) The geomembrane shall be a white-surfaced, coextruded geomembrane
   b) The white surface shall be installed upwards

F Extrudate Rod or Bead
1 Extrudate material shall be made from same type resin as the geomembrane
2 Additives shall be thoroughly dispersed
3 Materials shall be free of contamination by moisture or foreign matter

1 10 Equipment

A Welding equipment and accessories shall meet the following requirements
1 Gauges showing temperatures in apparatus (extrusion welder) or wedge (wedge welder) shall be present
2 An adequate number of welding apparati shall be available to avoid delaying work
3 Power source must be capable of providing constant voltage under combined line load

1 11 Deployment

A Assign each panel a simple and logical identifying code The coding system shall be subject to approval and shall be determined at the job site

B Visually inspect the geomembrane during deployment for imperfections and mark faulty or suspect areas

C Deployment of geomembrane panels shall be performed in a manner that will comply with the following guidelines
1 Unroll geomembrane using methods that will not damage geomembrane and will protect underlying surface from damage (spreader bar, protected equipment bucket)
2 Place ballast (commonly sandbags) on geomembrane which will not damage geomembrane to prevent wind uplift
3 Personnel walking on geomembrane shall not engage in activities or wear shoes that could damage it Smoking will not be permitted on the geomembrane

4 Do not allow heavy vehicular traffic directly on geomembrane Rubber-tired ATV's and trucks are acceptable if wheel contact is less than 6 psi
5 Protect geomembrane in areas of heavy traffic by placing protective cover over the geomembrane

D Sufficient material (slack) shall be provided to allow for thermal expansion and contraction of the material

1 12 Field Seaming

A Seams shall meet the following requirements
1 To the maximum extent possible, orient seams parallel to line of slope, i e , down and not across slope
2 Minimize number of field seams in corners, odd-shaped geometric locations and outside corners
3 Slope seams (panels) shall extend a minimum of five-feet beyond the grade break into the flat area
4 Use a sequential seam numbering system compatible with panel numbering system that is agreeable to the CONSULTANT and INSTALLER
5 Align seam overlaps consistent with the requirements of the welding equipment being used A 6-inch overlap is commonly suggested

B During Welding Operations
1 Provide at least one Master Seamer who shall provide direct supervision over other welders as necessary

C Extrusion Welding
1 Hot-air tack adjacent pieces together using procedures that do not damage the geomembrane
2 Clean geomembrane surfaces by disc grinder or equivalent
3 Purge welding apparatus of heat-degraded extrudate before welding

D Hot Wedge Welding
1 Welding apparatus shall be a self-propelled device equipped with an electronic controller which displays applicable temperatures
2 Clean seam area of dust, mud, moisture and debris immediately ahead of hot wedge welder
3 Protect against moisture build-up between sheets

E Trial Welds
1 Perform trial welds on geomembrane samples to verify welding equipment is operating properly
2 Make trial welds under the same surface and environmental conditions as the production welds, i e , in contact with subgrade and similar ambient temperature
3 Minimum of two trial welds per day, per welding apparatus, one made prior to the start of work and one completed at mid shift
4 Cut four, one-inch wide by six inch long test strips from the trial weld
5 Quantitatively test specimens for peel adhesion, and then for shear strength

6 Trial weld specimens shall pass when the results shown in Table 3 are achieved in both peel and shear test
   a The break, when peel testing, occurs in the liner material itself, not through peel separation (FTB)
   b The break is ductile
7 Repeat the trial weld, in its entirety, when any of the trial weld samples fail in either peel or shear
8 No welding equipment or welder shall be allowed to perform production welds until equipment and welders have successfully completed trial weld

F Seaming shall not proceed when ambient air temperature or adverse weather conditions jeopardize the integrity of the liner installation INSTALLER shall demonstrate that acceptable seaming can be performed by completing acceptable trial welds

G Defects and Repairs
1 Examine all seams and non-seam areas of the geomembrane for defects, holes, blisters, undispersed raw materials, and any sign of contamination by foreign matter
2 Repair and non-destructively test each suspect location in both seam and non-seam areas Do not cover geomembrane at locations that have been repaired until test results with passing values are available

1 13 <u>Field Quality Assurance</u>

A MANUFACTURER and INSTALLER shall participate in and conform to all terms and requirements of the Owner's quality assurance program CONTRACTOR shall be responsible for assuring this participation

B Quality assurance requirements are as specified in this Section and in the Field Installation Quality Assurance Manual if it is included in the contract

C Field Testing

1 Non-destructive testing may be carried out as the seaming progresses or at completion of all field seaming
   a Vacuum Testing
      1) Shall be performed in accordance with ASTM D 5641, Standard Practice for Geomembrane Seam Evaluation by Vacuum Chamber
   b Air Pressure Testing
      1) Shall be performed in accordance with ASTM D 5820, Standard Practice for Pressurized Air Channel Evaluation of Dual Seamed Geomembranes
   c Other approved methods

2 Destructive Testing (performed by CONSULTANT with assistance from INSTALLER)
   a Location and Frequency of Testing
      1) Collect destructive test samples at a frequency of one per every 1500 lineal feet of seam length

2) Test locations will be determined after seaming
3) Exercise Method of Attributes as described by GRI GM-14 (Geosynthetic Research Institute, http //www geosynthetic-institute org) to minimize test samples taken

b Sampling Procedures are performed as follows
1) INSTALLER shall cut samples at locations designated by the CONSULTANT as the seaming progresses in order to obtain field laboratory test results before the geomembrane is covered
2) CONSULTANT will number each sample, and the location will be noted on the installation as-built
3) Samples shall be twelve (12) inches wide by minimal length with the seam centered lengthwise
4) Cut a 2-inch wide strip from each end of the sample for field-testing
5) Cut the remaining sample into two parts for distribution as follows
   a) One portion for INSTALLER, 12-inches by 12 inches
   b) One portion for the Third Party laboratory, 12-inches by 18-inches
   c) Additional samples may be archived if required
6) Destructive testing shall be performed in accordance with ASTM D 6392, Standard Test Method for Determing the Integrity of Non-Reinforced Geomembrane Seams Produced Using Thermo-Fusion Methods
7) INSTALLER shall repair all holes in the geomembrane resulting from destructive sampling
8) Repair and test the continuity of the repair in accordance with these Specifications

3 Failed Seam Procedures
1) If the seam fails, INSTALLER shall follow one of two options
   a) Reconstruct the seam between any two passed test locations
   b) Trace the weld to intermediate location at least 10 feet minimum or where the seam ends in both directions from the location of the failed test
2) The next seam welded using the same welding device is required to obtain an additional sample, i e , if one side of the seam is less than 10 feet long
3) If sample passes, then the seam shall be reconstructed or capped between the test sample locations
4) If any sample fails, the process shall be repeated to establish the zone in which the seam shall be reconstructed

1 14 Repair Procedures

A Remove damaged geomembrane and replace with acceptable geomembrane materials if damage cannot be satisfactorily repaired

B Repair any portion of unsatisfactory geomembrane or seam area failing a destructive or non-destructive test

C INSTALLER shall be responsible for repair of defective areas

D Agreement upon the appropriate repair method shall be decided between CONSULTANT and INSTALLER by using one of the following repair methods

1 Patching- Used to repair large holes, tears, undispersed raw materials and contamination by foreign matter
2 Abrading and Re-welding- Used to repair short section of a seam
3 Spot Welding- Used to repair pinholes or other minor, localized flaws or where geomembrane thickness has been reduced
4 Capping- Used to repair long lengths of failed seams
5 Flap Welding- Used to extrusion weld the flap (excess outer portion) of a fusion weld in lieu of a full cap
6 Remove the unacceptable seam and replace with new material

E The following procedures shall be observed when a repair method is used

1 All geomembrane surfaces shall be clean and dry at the time of repair
2 Surfaces of the polyethylene which are to be repaired by extrusion welds shall be lightly abraded to assure cleanliness
3 Extend patches or caps at least 6 inches for extrusion welds and 4 inches for wedge welds beyond the edge of the defect, and around all corners of patch material

F Repair Verification

1 Number and log each patch repair (performed by CONSULTANT)
2 Non-destructively test each repair using methods specified in this Specification

1 15 Measurement and Payment

A Payment for geomembrane installation will be as per contract unit price per square foot, as measured parallel to liner surface, including designed anchor trench material and is based upon net lined area

B Net lined area is defined to be the true area of all surfaces to be lined plus designed burial in all anchor trenches, rubsheets, and sacrificial layers

C Prices shall include full compensation for furnishing all labor, material, tools, equipment, and incidentals

D Prices also include doing all the work involved in performing geomembrane installation completely as shown on the drawing, as specified herein, and as directed by the ENGINEER

Table 1 1 Minimum Values for Smooth Black-Surfaced HDPE Geomembranes

Property	Test Method[1]						
Thickness, mil (mm) Minimum Average Lowest Individual Reading	ASTM D 5199	30 (0 75) 27 (0 69)	40 (1 0) 36 (0 91)	60 (1 5) 54 (1 4)	80 (2 0) 72 (1 8)	100 (2 5) 90 (2 3)	120 (3 0) 108 (2 7)
Density, g/cm^3	ASTM D 1505	0 94	0 94	0 94	0 94	0 94	0 94

Carbon Black Content, %	ASTM D 1603, mod	2 0	2 0	2 0	2 0	2 0	2 0
Carbon Black Dispersion	ASTM D 5596	*Note 2*	*Note 2*	*Note 2*	*Note 2*	*Note 2*	*Note 2*
Tensile Properties (each direction)	ASTM D 6693						
Strength at Yield, lb/in (kN/m)		63 (11)	84 (15)	130 (23)	173 (30)	216 (38)	259 (45)
Strength at Break, lb/in (kN/m)		122 (21)	162 (28)	243 (43)	324 (57)	405 (71)	486 (85)
Elongation at Yield, %	(1 3" gauge length)	13	13	13	13	13	13
Elongation at Break, %	(2 0" gauge length)	700	700	700	700	700	700
Tear Resistance, lb (N)	ASTM D 1004	21 (93)	28 (124)	42 (187)	56 (249)	70 (311)	84 (373)
Puncture Resistance, lb (N)	ASTM D 4833	59 (263)	79 (352)	119 (530)	158 (703)	198 (881)	238 (1059)
Notched Constant Tensile Load, hours	ASTM D 5397, app	400	400	400	400	400	400
Oxidative Induction Time, min	ASTM D 3895	100	100	100	100	100	100

1 Some test procedures have been modified for application to geosynthetics All procedures and values are subject to change without prior notification

2 Only near spherical agglomerates are considered 9 of 10 views shall be Category 1 or 2 No more than one view Category 3

Table 1 2 Minimum Values for Smooth White-Surfaced HDPE Geomembranes

Property	Test Method[1]					
Thickness, mil (mm) Minimum Average Lowest Individual Reading	ASTM D 5199	30 (0 75) 27 (0 69)	40 (1 0) 36 (0 91)	60 (1 5) 54 (1 4)	80 (2 0) 72 (1 8)	100 (2 5) 90 (2 3)
Density, g/cm^3	ASTM D 1505	0 94	0 94	0 94	0 94	0 94
Carbon Black Content[2], %	ASTM D 1603	2 0	2 0	2 0	2 0	2 0
Carbon Black Dispersion	ASTM D 5596	*Note 4*	*Note 4*	*Note 4*	*Note 4*	*Note 4*
Tensile Properties (each direction)	ASTM D 6693					
Strength at Yield, lb/in (kN/m)		63 (11)	84 (15)	130 (23)	173 (30)	216 (38)

Strength at Break, lb/in (kN/m)		122 (21)	162 (28)	243 (43)	324 (57)	405 (71)
Elongation at Yield, %	(1 3” gauge length)	13	13	13	13	13
Elongation at Break, %	(2 0” gauge length)	700	700	700	700	700
Tear Resistance, lb (N)	ASTM D 1004	21 (93)	28 (124)	42 (187)	56 (249)	70 (311)
Puncture Resistance, lb (N)	ASTM D 4833	59 (263)	79 (352)	119 (530)	158 (703)	198 (881)
Notched Constant Tensile Load, hours	ASTM D 5397, app	400	400	400	400	400
Oxidative Induction Time(3), min	ASTM D 3895	100	100	100	100	100

1 Some test procedures have been modified for application to geosynthetics All procedures and values are subject to change without prior notification
2 GSE White may have overall ash content greater than 3 0% due to the white layer
3 The OIT values apply to the black layer only
4 Only near spherical agglomerates are considered 9 of 10 views shall be Category 1 or 2 No more than one view Category 3

Table 1 3 Minimum Values for Smooth Conductive HDPE Geomembranes

Property	Test Method(1)				
Thickness, mil (mm) Minimum Average Lowest Individual Reading	ASTM D 5199	 40 (1 0) 36 (0 91)	 60 (1 5) 54 (1 4)	 80 (2 0) 72 (1 8)	 100 (2 5) 90 (2 3)
Density, g/cm^3	ASTM D 1505	0 94	0 94	0 94	0 94
Carbon Black Content(2), %	ASTM D 1603, modified	2 0	2 0	2 0	2 0
Carbon Black Dispersion	ASTM D 5596	*Note 5*	*Note 5*	*Note 5*	*Note 5*
Tensile Properties(3) (each direction)	ASTM D 6693				
Strength at Yield, lb/in (kN/m) Strength at Break, lb/in (kN/m)		84 (15) 162 (28)	130 (23) 243 (43)	173 (30) 324 (57)	216 (38) 405 (71)
Elongation at Yield, %	(1 3” gauge length)	13	13	13	13
Elongation at Break, %	(2 0” gauge length)	700	700	700	700
Tear Resistance, lb (N)	ASTM D 1004	28 (124)	42 (187)	56 (249)	70 (311)
Puncture Resistance, lb (N)	ASTM D 4833	79 (352)	119 (530)	158 (703)	198 (881)
Notched Constant Tensile Load, hours	ASTM D 5397, appendix	400	400	400	400

Oxidative Induction Time[4], min	ASTM D 3895	100	100	100	100

[1] Some test procedures have been modified for application to geosynthetics All procedures and values are subject to change without prior notification

[2] GSE Conductive and GSE Conductive White may have an overall ash content of greater than 3 0% due to the conductive and/or white layers

[3] Due to surface effects caused by the conductive layer, these tensile properties are minimum average values

[4] The OIT values apply to the non-conductive black layer only

[5] Only near spherical agglomerates are considered 9 of 10 views shall be Category 1 or 2 No more than one view Category 3

Table 1 4 Minimum Values for Smooth Black-Surfaced LLDPE Geomembranes

Property	Test Method[1]					
Thickness, mil (mm) Minimum Average Lowest Individual Reading	ASTM D 5199	30 (0 75) 27 (0 69)	40 (1 0) 36 (0 91)	60 (1 5) 54 (1 4)	80 (2 0) 72 (1 8)	100 (2 5) 90 (2 3)
Density, g/cm^3	ASTM D 1505	0 92	0 92	0 92	0 92	0 92
Carbon Black Content, %	ASTM D 1603, mod	2 0	2 0	2 0	2 0	2 0
Carbon Black Dispersion	ASTM D 5596	*Note 2*	*Note 2*	*Note 2*	*Note 2*	*Note 2*
Tensile Properties (each direction)	ASTM D 6693					
Strength at Break, lb/in (kN/m)		114 (20)	152 (27)	228 (40)	304 (53)	380 (66)
Elongation at Break, %	(2 0" gauge length)	850	850	850	850	850
Tear Resistance, lb (N)	ASTM D 1004	16 (71)	22 (100)	33 (150)	44 (200)	55 (250)
Puncture Resistance, lb (N)	ASTM D 4833	46 (205)	62 (276)	92 (409)	123 (547)	154 (685)
Oxidative Induction Time, min	ASTM D 3895	100	100	100	100	100

[1] Some test procedures have been modified for application to geosynthetics All procedures and values are subject to change without prior notification

[2] Only near spherical agglomerates are considered 9 of 10 views shall be Category 1 or 2 No more than one view Category 3

Table 1 5 Minimum Values for Smooth White-Surfaced LLDPE Geomembranes

Property	Test Method[1]		
Thickness, mil (mm) Minimum Average Lowest Individual Reading	ASTM D 5199	40 (1 0) 36 (0 91)	60 (1 5) 54 (1 4)
Density, g/cm^3	ASTM D 1505	0 92	0 92

Carbon Black Content[2], %	ASTM D 1603, modified	2 0	2 0
Carbon Black Dispersion	ASTM D 5596	*Note 4*	*Note 4*
Tensile Properties *(each direction)* Strength at Break, lb/in (kN/m)	ASTM D 6693	 152 (27)	 228 (40)
Elongation at Break, %	(2 0" gauge length)	850	850
Tear Resistance, lb (N)	ASTM D 1004	22 (100)	33 (150)
Puncture Resistance, lb (N)	ASTM D 4833	62 (276)	92 (409)
Oxidative Induction Time[3], min	ASTM D 3895	100	100

[1] Some test procedures have been modified for application to geosynthetics All procedures and values are subject to change without prior notification

[2] GSE UltraFlex White may have overall ash content greater than 3 0% due to the white layer

[3] The OIT values apply to the black layer only

[4] Only near spherical agglomerates are considered 9 of 10 views shall be Category 1 or 2 No more than one view Category 3

Table 2 1 Minimum Values for Black Surfaced Coextruded Textured HDPE Geomembranes

Property	Test Method[1]					
Thickness, mil (mm) Minimum Average Lowest Individual Reading	ASTM D 5994	 30 (0 75) 27 (0 69)	 40 (1 0) 36 (0 91)	 60 (1 5) 54 (1 4)	 80 (2 0) 72 (1 8)	 100 (2 5) 90 (2 3)
Density, g/cm^3	ASTM D 1505	0 94	0 94	0 94	0 94	0 94
Carbon Black Content, %	ASTM D 1603, modified	2 0	2 0	2 0	2 0	2 0
Carbon Black Dispersion	ASTM D 5596	*Note 4*	*Note 4*	*Note 4*	*Note 4*	*Note 4*
Tensile Properties[2] *(each direction)* Strength at Yield, lb/in (kN/m) Strength at Break, lb/in (kN/m)	ASTM D 6693	 63 (11) 45 (8)	 84 (15) 60 (11)	 130 (23) 90 (16)	 173 (30) 120 (21)	 216 (38) 150 (27)
Elongation at Yield, % Elongation at Break, %	(1 3" gauge length) (2 0" gauge length)	13 150	13 150	13 150	13 150	13 150
Tear Resistance, lb (N)	ASTM D 1004	21 (93)	28 (124)	42 (187)	56 (249)	70 (311)
Puncture Resistance, lb (N)	ASTM D 4833	54 (240)	72 (320)	108 (480)	144 (641)	180 (801)
Notched Constant Tensile Load [3], hours	ASTM D 5397, appendix	400	400	400	400	400
Oxidative Induction Time, min	ASTM D 3895	100	100	100	100	100

[1] Some test procedures have been modified for application to geosynthetics All procedures and values are subject to change without prior notification
[2] The combination of stress concentrations due to coextrusion texture geometry and the small specimen size results in large variations of test results Therefore, these tensile properties are minimum average roll values
[3] NCTL on coextruded textured product is conducted on representative smooth membrane samples
[4] Only near spherical agglomerates are considered 9 of 10 views shall be Category 1 or 2 No more than one view Category 3

Table 2 2 Minimum Values for White-Surfaced Coextruded Textured HDPE Geomembranes

Property	Test Method[1]					
Thickness, mil (mm) Minimum Average Lowest Individual Reading	ASTM D 5994	30 (0 75) 27 (0 69)	40 (1 0) 36 (0 91)	60 (1 5) 54 (1 4)	80 (2 0) 72 (1 8)	100 (2 5) 90 (2 3)
Density, g/cm^3	ASTM D 1505	0 94	0 94	0 94	0 94	0 94
Carbon Black Content[6], %	ASTM D 1603, modified	2 0	2 0	2 0	2 0	2 0
Carbon Black Dispersion	ASTM D 5596	*Note 4*	*Note 4*	*Note 4*	*Note 4*	*Note 4*
Tensile Properties[2] *(each direction)*	ASTM D 6693					
Strength at Yield, lb/in (kN/m)		63 (11)	84 (15)	130 (23)	173 (30)	216 (38)
Strength at Break, lb/in (kN/m)		45 (8)	60 (11)	90 (16)	120 (21)	150 (27)
Elongation at Yield, % Elongation at Break, %	(1 3" gauge length) (2 0" gauge length)	13 150	13 150	13 150	13 150	13 150
Tear Resistance, lb (N)	ASTM D 1004	21 (93)	28 (124)	42 (187)	56 (249)	70 (311)
Puncture Resistance, lb (N)	ASTM D 4833	54 (240)	72 (320)	108 (480)	144 (641)	180 (801)
Notched Constant Tensile Load *(3)*, hours	ASTM D 5397, appendix	400	400	400	400	400
Oxidative Induction Time, min (5)	ASTM D 3895	100	100	100	100	100

[1] Some test procedures have been modified for application to geosynthetics All procedures and values are subject to change without prior notification
[2] The combination of stress concentrations due to coextrusion texture geometry and the small specimen size results in large variations of test results Therefore, these tensile properties are minimum average roll values
[3] NCTL on coextruded textured product is conducted on representative smooth membrane samples
[4] Only near spherical agglomerates are considered 9 of 10 views shall be Category 1 or 2 No more than one view Category 3
[5] The OIT values apply to the black layer only
[6] GSE HD Textured White may have overall ash content greater than 3% due to the white layer

Table 2 3 Minimum Values for Black Surfaced Coextruded Textured LLDPE Geomembranes

Property	Test Method[1]			
Thickness, mil (mm) Minimum Average Lowest Individual Reading	ASTM D 5994	 40 (1 0) 36 (0 91)	 60 (1 5) 54 (1 4)	 80 (2 0) 72 (1 8)
Density, g/cm^3	ASTM D 1505	0 92	0 92	0 92
Carbon Black Content, %	ASTM D 1603, modified	2 0	2 0	2 0
Carbon Black Dispersion	ASTM D 5596	*Note 3*	*Note 3*	*Note 3*
Tensile Properties[2] *(each direction)*	ASTM D 6693			
Strength at Break, lb/in (kN/m)		100 (18)	132 (23)	176 (30)
Elongation at Break, %	(2 0" gauge length)	500	500	500
Tear Resistance, lb (N)	ASTM D 1004	22 (100)	33 (150)	44 (200)
Puncture Resistance, lb (N)	ASTM D 4833	48 (214)	73 (325)	97 (432)
Oxidative Induction Time, min	ASTM D 3895	100	100	100

[1] Some test procedures have been modified for application to geosynthetics All procedures and values are subject to change without prior notification

[2] The combination of stress concentrations due to coextrusion texture geometry and the small specimen size results in large variations of test results Therefore, these tensile properties are average roll values

[3] Only near spherical agglomerates are considered 9 of 10 views shall be Category 1 or 2 No more than one view Category 3

Table 2 4 Minimum Values for White-Surfaced Coextruded Textured LLDPE Geomembranes

Property	Test Method[1]			
Thickness, mil (mm) Minimum Average Lowest Individual Reading	ASTM D 5994	 40 (1 0) 36 (0 91)	 60 (1 5) 54 (1 4)	 80 (2 0) 72 (1 8)
Density, g/cm^3	ASTM D 1505	0 92	0 92	0 92
Carbon Black Content[2], %	ASTM D 1603, modified	2 0	2 0	2 0
Carbon Black Dispersion	ASTM D 5596	*Note 5*	*Note 5*	*Note 5*
Tensile Properties[3] *(each direction)*	ASTM D 6693			
Strength at Break, lb/in (kN/m)		100 (18)	132 (23)	176 (30)
Elongation at Break, %	(2 0" gauge length)	500	500	500
Tear Resistance, lb (N)	ASTM D 1004	22 (100)	33 (150)	44 (200)

Puncture Resistance, lb (N)	ASTM D 4833	48 (214)	73 (325)	97 (432)
Oxidative Induction Time [(4)], min	ASTM D 3895	100	100	100

[1]Some test procedures have been modified for application to geosynthetics All procedures and values are subject to change without pnor notification

[2] GSE UltraFlex White Textured may have an overall ash content greater than 3 0% due to the white layer

[3] The combination of stress concentrations due to coextrusion texture geometry and the small specimen size results in large variations of test results Therefore, these tensile properties are average roll values

[4] The OIT values apply to the black layer only

[5] Only near spherical agglomerates are considered 9 of 10 views shall be Category 1 or 2 No more than one view Category 3

Table 3 1 Minimum Weld Values for HDPE Geomembranes

Property	Test Method	30 (0 75)	40 (1 0)	60 (1 5)	80 (2 0)	100 (2 5)	120 (3 0)
Peel Strength (fusion), ppi (kN/m)	ASTM D 6392	49 (8 6)	65 (11 4)	98 (17 2)	130 (22 8)	162 (28 4)	196 (34 3)
Peel Strength (extrusion), ppi (kN/m)	ASTM D 6392	39 (6 8)	52 (9 1)	78 (13 7)	104 (18 2)	130 (22 8)	157 (27 5)
Shear Strength (fusion & ext), ppi (kN/m)	ASTM D 6392	61 (10 7)	81 (14 2)	121 (21 2)	162 (28 4)	203 (35 5)	242 (42 4)

Table 4 1 Minimum Weld Values for LLDPE Geomembranes

Property	Test Method	30 (0 75)	40 (1 0)	60 (1 5)	80 (2 0)	100 (2 5)
Peel Strength (extrusion), ppi (kN/m)	ASTM D 6392	36 (6 3)	48 (8 4)	72 (12 6)	96 (16 8)	120 (21 0)
Peel Strength (fusion), ppi (kN/m)	ASTM D 6392	38 (6 7)	50 (8 8)	75 (13 1)	100 (17 5)	125 (21 9)
Shear Strength (fusion & ext), ppi (kN/m)	ASTM D 6392	45 (7 9)	60 (10 5)	90 (15 8)	120 (21 0)	150 (26 3)

END OF SECTION

NON-WOVEN GEOTEXTILE

Geomembrane Puncture Protection, Geotextile Selection - Design Calculator

Problem Statement

There are many circumstances where geomembranes are placed on or beneath soils containing relatively large-sized stones For example, poorly prepared soil subgrade with stones protruding from the surface and cases where crushed-stoned drainage layers are to be placed above the geomembrane

In all of these situations, a nonwoven needle-punched geotextile can provide significant puncture protection to the geomembrane The issue of determining the required mass per unit area of the geotextile becomes critical

The method presented herein (Koerner, 1998) focuses on the protection of 1 5 mm thick HDPE geomembranes The method uses the design by function approach

$$FS = \frac{p_{allow}}{p_{act}}$$

where

FS	factor of safety against geomembrane puncture
P_{act}	actual pressure due to the landfill contents or surface impoundment
P_{allow}	allowable pressure using different types of geotextiles and site specific conditions

p_{allow} is determined by the following equation

$$P_{allow} = \left(50 + 0\ 00045 \frac{M}{H^2}\right) \left[\frac{1}{MF_S * MF_{PD} * MF_A}\right] \left[\frac{1}{RF_{CR} * RF_{CBD}}\right]$$

where

Symbol	Name	Unit
P_{allow}	allowable pressure	kPa
M	geotextile mass per unit area	g/m2
H	height of the protrusion above the subgrade	m
MF_S	modification factor for protrusion shape	-
MF_{PD}	modification factor for packing density	-

MF_A	modification factor for arching in solids	-
RF_{CR}	reduction factor for long-term creep	-
RF_{CBD}	reduction factor for long-term chemical/biological degradation	-

Modification Factors and Reduction Factors for Geomembrane Protection Design Using Nonwoven Needle-Punched Geotextile

MF_S		MF_{PD}		MF_A	
Angular	1 0	Isolated	1 0	Hydrostatic	1 0
Subrounded	0 5	Dense 38 mm	0 83	Geostatic shallow	0 75
Rounded	0 25	Dense 25 mm	0 67	Geostatic mod	0 50
		Dense 12mm	0 50	Geostatic deep	0 25

RF_{CBD}		Protrusion (mm) / Mass per Unit area (g/m²)	RF_{CR} 38	25	12
Mild leachate	1 1	Geomembrane alone	N/R	N/R	N/R
Moderate leachate	1 3	270	N/R	N/R	>1 5
Harsh leachate	1 5	550	N/R	1 5	1 3
		1100	1 3	1 2	1 1
		>1100	1 2	1 1	1 0

N/R = Not Recommended

Input Values

FS	3	**Safety Factor against Puncture (>= 3 is recommended)**
d	244	**Depth of material on top of geomembrane (m)**
	8 8	**Unit weight of material on top of geomembrane (kN/m3)**
H	0 019	**Protrusion height (m)**

Modification and Reduction Factors

MF_S	0 5
MF_{PD}	0 5
MF_A	0 25
RF_{CR}	1 5
RF_{CBD}	1 3

Calculate Geotextile Mass Per Unit

Solution

Required Geotextile Mass per Unit area 590 g/m^2

17 4 oz/yd2

ULTRA-VERA

TENAX® Corporation

Ultra-Vera™ Highly UV Stable Geotextile
UV 1320

Ultra-Vera™ geotextiles have been created to reduce the liability of engineers, contractors, and owners Project scheduling often pushes existing geotextile product technology to exposure limits that may cause deterioration The name Ultra-Vera™ is derived from Latin, and means "Most Truth" Specifying Ultra-Vera™, the most durable geotextile, with its application-oriented colors assures that your project will be a success

Ultra-Vera™ is a highly U V stabilized geotextile Special additives are incorporated to provide high chemical resistance Specific chemical resistance data is available upon request for chemicals with pH values that range from 2-13 Tests by our laboratory conducted in accordance with ASTM D 4354 sampling and testing frequencies have resulted in the following properties

90% UV Resistance @ 1000 Hours

Property	Test Methods	Units	Minimum Average Roll Value[1]	Test Frequency
Physical				
Minimum Weight	ASTM D 5261	oz/yd (g/m²)	32 (1084)	100 000 sf
Mechanical				
Durability	**ASTM G 154**	**U V Resistance (1000 hrs)**	**90 %**	**Every Formulation**
Puncture Resistance	ASTM D 4833	lb (N)	270 (1202)	100 000 sf
Tear Strength	ASTM D 4533	lb (N)	215 (957)	100 000 sf
Grab Strength	ASTM D 4632	lb (N)	685 (3048)	100 000 sf
Hydraulic				
Water Flow Rate	ASTM D 4491	gpm/ft (m/s)	Available	500 000 sf
Permittivity	ASTM D 4491	sec 1	upon request	500 000 sf
Water Permeability	ASTM D 4491	cm/sec		500 000 sf
AOS	ASTM D 4751	Sieve size (mm)	200 (0 075)*	500 000 sf

Packaging			**Typical Dimensions**
Roll width	Direct Measure	ft (m)	9 0 (2 74)
Roll length	Direct Measure	ft (m)	300 (91 4)
Roll area	Direct Measure	yd² (m²)	300 (251)
Roll weight	Direct Measure	lb (kg)	634 (287)
Roll diameter	Direct Measure	in	32
Core ID	Direct Measure	in	4 25
Labeling		Product code roll dimensions finished product lot and roll number	

1 Values in weaker principle direction Unless noted otherwise these values represent minimum average roll values (i e calculated as the typical minus two standard deviations statistically yielding a 97 5 / degree of confidence that any sample taken during quality assurance testing will exceed the value reported.)
2 Smaller sieve size number represents the maximum average roll value
3 ASTM D-3786 is no longer a recognized test standard by the American Society for Testing and Materials
Determined at time of manufacturing Storage and handling conditions that differ from those found in ASTM D 4873 88 may influence these properties

To alleviate concern for UV exposure all Tenax Ultra-Vera geotextiles are UV stabilized using Hindered Amine Light stabilized polypropylene Our UV resistance meets or exceeds 90% strength retention for at least 1000 hours

Hindered Amine Light Stabilizers (HALS) are the most effective of the light stabilizers for polypropylene HALS work by retarding the photodegradation of plastics by decomposing the radical intermediates formed during the degradation process

Tenax uses a continuous filament process which allows us to control the formulation of the extruded polymer by adding increased stabilizers during processing The UV resistance can be increased far beyond that of other geotextiles and therefore extend the time Ultra-Vera™ may be left uncovered without damage or degradation

TENAX Engineered for Life

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LEACHATE COLLECTION PIPING

Chet,

I would like to confirm the details of our phone conversation today We recommend our 6" 1500 psi internally rated product for you application Depending on how many slots and the % open area you require we may have to go up to one of our heavier products like 1750, 2000, 2250 or 2500 psi Obviously the more slots we cut into the pipe the weaker it will become Unfortunately it is very hard to test the performance derogation when the pipe is slotted We do have experience we can rely on running our down hole casing products which were slotted One of my concerns was the possibility of heavy equipment running over the pipe with very little cover This could be a problem with the bigger sizes and again may be a good reason to go to heavier pipe Either way we should be able to accommodate your requirement

Following is my understanding of the application

It is a landfill where we will see up to 1200 ft of cover with a density of 1500lbs/cu yard
The temperature is ambient and there will be no pressure
The system is a grid of pipe and fittings which is slotted and gravel packed for the purpose of collecting waste leach water with a PH of 5 to 8 5
It is 1000 acre site and you estimate that you will need about 165,000 ft of pipe and fittings
There will be several smaller branches coming of the main lines
the price of the 6" 1500 line pipe is $11 13/ft (I1515GS)

I hope this agrees with your understanding We look forward hearing more about you application
Regards
Steve

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GEOCOMPOSITE DRAINAGE LAYER

SECTION 02621

GEOCOMPOSITE DRAINAGE LAYER

PART 1 - GENERAL

1 01 SECTION INCLUDES

A Specifications and guidelines for MANUFACTURING and INSTALLING geocomposite

1 02 REFERENCES

A American Society for Testing and Materials (ASTM)

1 D 1505-98 Standard Test Method for Density of Plastics by the Density-Gradient Technique
2 D 1603-94 Standard Test Method for Carbon Black in Olefin Plastics
3 D 4355-02 Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus
4 D 4491-99 Standard Test Method for Water Permeability of Geotextiles by Permittivity
5 D 4716-00 Standard Test Method for Determining the (In-Plane) Flow Rate Per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head
6 D 4751-99 Standard Test Method for Determining Apparent Opening Size of a Geotextile
7 D 4833-88 (1996) Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes and Related Products
8 D 5035-95 Standard Test Method for Breaking Force and Elongation of Textile Fabrics (Strip Method)
9 D 5199-99 Standard Test Method for Measuring Nominal Thickness of Geotextiles and Geomembranes
10 D 5261-92 (1996) Standard Test Method for Measuring the Mass Per Unit Area of Geotextiles

B Geosynthetic Research Institute (GRI)

1 GRI GC-7 Determination of Adhesion and Bond Strength of Geocomposites

C Relevant publications from the Environmental Protection Agency (EPA)

1 Daniel, D E and R M Koerner, (1993), *Technical Guidance Document Quality Assurance and Quality Control for Waste Containment Facilities,* EPA/600/R-93/182

1 03 DEFINITIONS

A Quality Assurance Officer (CONSULTANT)- Party, independent from MANUFACTURER and INSTALLER that is responsible for observing and documenting activities related to quality assurance during the lining system construction

B ENGINEER- The individual or firm responsible for the design and preparation of the project's Contract Drawings and Specifications

C Geocomposite Manufacturer (MANUFACTURER)- The party responsible for manufacturing the geocomposite rolls

D Geosynthetic Quality Assurance Laboratory (TESTING LABORATORY)- Party, independent from the MANUFACTURER and INSTALLER, responsible for conducting laboratory tests on samples of geosynthetics obtained at the site or during manufacturing, usually under the direction of the OWNER

E INSTALLER- Party responsible for field handling, transporting, storing and deploying the geocomposite

F Lot- A quantity of resin (usually the capacity of one rail car) used to manufacture polyethylene geocomposite rolls The finished rolls will be identified by a roll number traceable to the resin lot

1 04 QUALIFICATIONS

A MANUFACTURER
1 Geocomposite shall be manufactured by the following
a GSE Lining Technology, Inc
b approved equal
2 MANUFACTURER shall have manufactured a minimum of 10,000,000 square feet of polyethylene geocomposite material during the last year

B INSTALLER
1 Installation shall be performed by one of the following installation companies (or approved equal)
a GSE Lining Technology, Inc
b GSE Approved Dealer/ Installer
2 INSTALLER shall have installed a minimum of 500,000 square feet of geocomposite

3 INSTALLER shall have worked in a similar capacity in complexity to the project described in the contract documents, and with in at least 500,000 square feet of geonet installation on each project

4 The Installation Supervisor shall have worked in a similar capacity on projects similar in size and complexity to the project described in the Contract Documents

1 05 MATERIAL LABELING, DELIVERY, STORAGE AND HANDLING

A Labeling- Each roll of geocomposite delivered to the site shall be wrapped and labeled by the MANUFACTURER The label will identify
1 manufacturer's name
2 product identification
3 length
4 width
5 roll number

B Delivery- Rolls of geonet will be prepared to ship by appropriate means to prevent damage to the material and to facilitate off-loading

C Storage- The on-site storage location for the geocomposite, provided by the CONTRACTOR to protect the geonet from abrasions, excessive dirt and moisture shall have the following characteristics
1 level (no wooden pallets)
2 smooth
3 dry
4 protected from theft and vandalism
5 adjacent to the area being lined

D Handling
1 The CONTRACTOR and INSTALLER shall handle all geocomposite in such a manner as to ensure it is not damaged in any way
2 The INSTALLER shall take any necessary precautions to prevent damage to underlying layers during placement of the geocomposite

1 06 WARRANTY

A Material shall be warranted, on a pro-rata basis against defects for a period of 1-year from the date of the geocomposite installation

B Installation shall be warranted against defects in workmanship for a period of 1-year from the date of geocomposite completion

PART 2 - PRODUCTS

2 01 GEOCOMPOSITE PROPERTIES

A A geocomposite shall be manufactured by extruding two crossing strands to form a bi-planar drainage net structure with a non-woven geotextile bonded to one or both sides

B The geocomposite specified shall have properties that meet or exceed the values listed in the following tables below

GSE FabriNet

TESTED PROPERTY	TEST METHOD	FREQUENCY	MINIMUM AVERAGE ROLL VALUE[1]		
Geocomposite			**6 oz/yd**	**8 oz/yd[2]**	**10 oz/yd**
Product Code			F4 [illegible]0600605	F4_0800805	F4 [illegible]
Transmissivity gal min/ft (m sec)	ASTM D 4716 00	1/540 000 ft	0 48 ([illegible] x 10)	0 48 (x 10)	0 4 [illegible] x 10
Ply Adhesion lb in (g cm)	GRI GC 7	1/50 000 ft	1 0 (178)	1 0 (178)	1 0 (178)
Roll Width ft (m)			14 (4 4)	14 5 (4 4)	14 5 (4 4)
Roll Length ft (m)			230 (70 1)	00 (60)	190 (58 0)
Roll Area ft (m)			3 335 (310)	2 900 (269)	2 755 (256)
Geonet core[b]					
Transmissivity gal min ft (m sec)	ASTM D 4716 00		9 6 x 10	9 66 (2 x 10)	9 66 (2 x 10)
Thickness mil (mm)	ASTM D 5199	1 50 000 ft	00 ( )	200 (5)	200
Density g cm	ASTM D 1505	1 50 000 ft	0 94	0 94	0 94
Tensile Strength (MD) lb in (N mm)	ASTM D 5035	1 50 000 ft	45 (7)	45 (7 9)	45 (7 9)
Carbon Black Content	ASTM D 1603	1 50 000 ft	2 0	2 0	2 0
Geotextile (prior to lamination)[c]					
Mass per Unit Area oz yd (g m)	ASTM D 5261	1 90 000 ft	6 (200)	8 (270)	10 (335)
Grab Tensile lb (N)	ASTM D 4632	1 90 000 ft	170 (755)	(0 (97)	260 (1 1 5)
Puncture Strength lb (N)	ASTM D 4833	1 90 000 ft	90 (395)	120 (535)	165 (735)
AOS US sieve (mm)	ASTM D 4751	1 540 000 ft	70 (0 21)	80 (0 180)	100 (0 150)
Permittivity sec	ASTM D 4491	1 540 000 ft	1 5	1 5	1 2
Flow Rate gpm ft (lpm m)	ASTM D 4491	1 540 000 ft	110 (4 480)	110 (4 480)	85 (3 460)
UV Resistance retained	ASTM D 4355 (after 500 hours)	once per formulation	70	70	70

NOTES

[a] Gradient of 0 1 normal load of 10 000 psf water at 70 between steel plates for 15 minutes

[b] Component properties prior to lamination

- [c] Several geotextiles are available and may be supplied as determined by GSE

[d] These are MARV values that are based on the cumulative results of specimens tested and determined by GSE AOS in mm is maximum average roll value

GSE FabriNet HF

TESTED PROPERTY	TEST METHOD	FREQUENCY	MINIMUM AVERAGE ROLL VALUE[d]		
Geocomposite			**6 oz/yd²**	**8 oz/yd²**	**10 oz/yd**
Product Code			F52060060S	F52080080S	F52100100S
Transmissivity[a] gal/min/ft (m^2/sec)	ASTM D 4716 00	1/540 000 ft²	2 41 ($5x10^{-4}$)	2 41 ($5x10^{-4}$)	2 41 ($5x10^{-4}$)
Ply Adhesion lb/in (g/cm)	GRI GC 7	1/50 000 ft²	1 0 (178)	1 0 (178)	1 0 (178)
Roll Width ft (m)			14 5 (4 4)	14 5 (4 4)	14 5 (4 4)
Roll Length ft (m)			200 (60)	190 (57 9)	180 (54 9)
Roll Area ft² (m²)			2 900 (269)	2 755 (256)	2 610 (242)
Geonet core[b]					
Transmissivity[a] gal/min/ft (m^2/sec)	ASTM D 4716-00		14 49 ($3x10^{-3}$)	14 49 ($3x10^{-3}$)	14 49 ($3x10^{-3}$)
Thickness mil (mm)	ASTM D 5199	1/50 000 ft²	250 (6 3)	250 (6 3)	250 (6 3)
Density g/cm³	ASTM D 1505	1/50 000 ft²	0 94	0 94	0 94
Tensile Strength (MD) lb/in (N/mm)	ASTM D 5035	1/50 000 ft²	55 (9 6)	55 (9 6)	55 (9 6)
Carbon Black Content %	ASTM D 1603	1/50 000 ft²	2 0	2 0	2 0
Geotextile (prior to lamination)[b,c]					
Mass per Unit Area oz/yd² (g/m²)	ASTM D 5261	1/90 000 ft²	6 (200)	8 (270)	10 (335)
Grab Tensile lb (N)	ASTM D 4632	1/90 000 ft²	170 (755)	220 (975)	260 (1 155)
Puncture Strength lb (N)	ASTM D 4833	1/90 000 ft²	90 (395)	120 (525)	165 (725)
AOS US Sieve (mm)	ASTM D 4751	1/540 000 ft²	70 (0 212)	80 (0 180)	100 (0 150)
Permittivity (sec^{-1})	ASTM D 4491	1/540 000 ft²	1 5	1 5	1 2
Flow Rate gpm/ft² (l/min/m²)	ASTM D 4491	1/540 000 ft²	110 (4 480)	110 (4 480)	85 (3 460)
UV Resistance % Retained	ASTM D 4355 (after 500 hours)	once per formulation	70	70	70

NOTES

- [a]Gradient of 0 1 normal load of 10 000 psf water at 70 F between stainless steel plates for 15 minutes

  [b]Component properties prior to lamination
- [c]Several geotextiles are available and may be supplied as determined by GSE

  [d]These are MARV values and are based on the cumulative results of specimens tested and as determined by GSE AOS in mm is a maxumum average roll value

GSE FabrıNet HS

TESTED PROPERTY	TEST METHOD	FREQUENCY	MINIMUM AVERAGE ROLL VALUE[d]		
Geocomposıte			**6 oz/yd^2**	**8 oz/yd^2**	**10 oz/yd^2**
Product Code			F72060060S	F72080080S	F72100100S
Transmıssıvıty[a] gal/mın/ft (m^2/sec)	ASTM D 4716-00	1/540 000 ft^2	3 38 (7 0 x 10^{-4})	3 38 (7 0 x 10^{-4})	3 38 (7 0 x 10^{-4})
Ply Adhesıon lb/ın (g/cm)	GRI GC 7	1/50 000 ft^2	1 0 (178)	1 0 (178)	1 0 (178)
Roll Wıdth ft (m)			14 5 (4 4)	14 5 (4 4)	14 5 (4 4)
Roll Length ft (m)			180 (54)	170 (51)	160 (48)
Roll Area ft^2 (m^2)			2 610 (242)	2 465 (229)	2 320 (215)
Geonet core[b]					
Transmıssıvıty[a] gal/mın/ft (m^2/sec)	ASTM D 4716 00		28 98 (6 x 10^{-3})	28 98 (6 x 10^{-3})	28 98 (6 x 10^{-3})
Thıckness mıl (mm)	ASTM D 5199	1/50 000 ft^2	275 (7)	275 (7)	275 (7)
Densıty g/cm^3	ASTM D 1505	1/50 000 ft^2	0 94	0 94	0 94
Tensıle Strength (MD) lb/in (N/mm)	ASTM D 5035	1/50 000 ft^2	65 (11 5)	65 (11 5)	65 (11 5)
Carbon Black Content %	ASTM D 1603	1/50 000 ft^2	2 0	2 0	2 0
Geotextıle (prıor to lamınatıon)[b,c]					
Mass per Unıt Area oz/yd^2 (g/m^2)	ASTM D 5261	1/90 000 ft^2	6 (200)	8 (270)	10 (335)
Grab Tensıle lb (N)	ASTM D 4632	1/90 000 ft^2	170 (755)	220 (975)	260 (1 155)
Puncture Strength lb (N)	ASTM D 4833	1/90 000 ft^2	90 (395)	120 (525)	165 (725)
AOS US Sıeve (mm)	ASTM D 4751	1/540 000 ft^2	70 (0 212)	80 (0 180)	100 (0 150)
Permıttıvıty (sec^{-1})	ASTM D 4491	1/540 000 ft^2	1 5	1 5	1 2
Flow Rate gpm/ft^2 (l/mın/m^2)	ASTM D 4491	1/540 000 ft^2	110 (4 480)	110 (4 480)	85 (3 460)
UV Resıstance % Retaıned	ASTM D 4355 (after 500 hours)	once per foımulatıon	70	70	70

NOTES:

- [a]Gradıent of 0 1 normal load of 10 000 psf water at 70 F (20 C) between staınless steel plates for 15 mınutes
- [b]Component propertıes prıor to lamınatıon

[c]Several geotextıles are avaılable and may be supplıed as determıned by GSE

[d]These are MARV values and are based on the cumulatıve results of specımens tested by GSE AOS ın mm ıs a maxumum average roll value

GSE FabriNet UF

TESTED PROPERTY	TEST METHOD	FREQUENCY	MINIMUM AVERAGE ROLL VALUE[d]		
Geocomposite			**6 oz/yd²**	**8 oz/yd²**	**10 oz/yd²**
Product Code			F82060060S	F82080080S	F82100100S
Transmissivity[a], gal/min/ft (m²/sec)	ASTM D 4716-00	1/540 000 ft²	4 35 (9 0 x 10)	4 35 (9 0 x 10⁻⁴)	4 35 (9 0 x 10⁻⁴)
Ply Adhesion lb/in (g/cm)	GRI GC 7	1/50 000 ft²	1 0 (178)	1 0 (178)	1 0 (178)
Roll Width ft (m)			14 5 (4 4)	14 5 (4 4)	14 5 (4 4)
Roll Length ft (m)			160 (48)	150 (45)	140 (42)
Roll Area, ft² (m²)			2,320 (215)	2,175 (202)	2 030 (188)
Geonet core[b]					
Transmissivity[a] gal/min/ft (m²/sec)	ASTM D 4716 00		38 64 (8 x 10⁻³)	38 64 (8 x 10⁻³)	38 64 (8 x 10⁻³)
Thickness mil (mm)	ASTM D 5199	1/50 000 ft²	300 (7 6)	300 (7 6)	300 (7 6)
Density g/cm³	ASTM D 1505	1/50,000 ft²	0 94	0 94	0 94
Tensile Strength (MD) lb/in (N/mm)	ASTM D 5035	1/50 000 ft²	75 (13 3)	75 (13 3)	75 (13 3)
Carbon Black Content, %	ASTM D 1603	1/50 000 ft²	2 0	2 0	2 0
Geotextile (prior to lamination)[b,c]					
Mass per Unit Area oz/yd² (g/m²)	ASTM D 5261	1/90 000 ft²	6 (200)	8 (270)	10 (335)
Grab Tensile lb (N)	ASTM D 4632	1/90 000 ft²	170 (755)	220 (975)	260 (1 155)
Puncture Strength lb (N)	ASTM D 4833	1/90 000 ft²	90 (395)	120 (525)	165 (725)
AOS US Sieve (mm)	ASTM D 4751	1/540 000 ft²	70 (0 212)	80 (0 180)	100 (0 150)
Permittivity (sec⁻¹)	ASTM D 4491	1/540 000 ft²	1 5	1 5	1 2
Flow Rate gpm/ft² (l/min/m²)	ASTM D 4491	1/540 000 ft²	110 (4,480)	110 (4 480)	85 (3 460)
UV Resistance % Retained	ASTM D 4355 (after 500 hours)	once per fomulation	70	70	70

NOTES:

- [a]Gradient of 0 1 normal load of 10 000 psf water at 70 F (20 C) between stainless steel plates for 15 minutes

[b]Component properties prior to lamination Net thickness is a typical value

[c]Several geotextiles are available and may be supplied as determined by GSE

[d]These are MARV values and are based on the cumulative results of specimens tested by GSE AOS in mm is a maximum average roll value

C Resin

1 Resin shall be new first quality, compounded polyethylene resin
2 Natural resin (without carbon black) shall meet the following additional minimum requirements

Table 02621-3

Property	Test Method [1]	Value
Density (g/cm3)	ASTM D 1505	>0 94
Melt Flow Index (g/10 min)	ASTM D 1238	≤1 0

[1]GSE utilizes test equipment and procedures that enable effective and economical confirmation that the product will conform to specifications based on the noted procedures Some test procedures have been modified for application to geosynthetics All procedures and values are subject to change without prior notification

2 02 MANUFACTURING QUALITY CONTROL

A The geocomposite shall be manufactured in accordance with the Manufacturer's Quality Control Plan submitted to and approved by the ENGINEER

B The geocomposite shall be tested according to the test methods and frequencies listed below

Table 02621-4

Manufacturing Quality Control Test Frequencies			
Characteristics	**Test Method**	**Units**	**FREQUENCY**
			Bi-Planar
Resin			
Polymer Density	ASTM D 1505	g/cm^3	Once Per Lot
Melt Flow Index	ASTM D 1238	g/10 min	Once Per Lot
Geonet Test			
Carbon Black	ASTM D 1603	%	1/50,000 ft^2
Tensile Strength, MD	ASTM D 5035	lbs/ ft	1/50,000 ft^2
Density	ASTM D 1505	g/cm^3	1/50,000 ft^2
Geotextile Tests			
Mass per Unit Area	ASTM D 5261	oz/yd^2	1/90,000 ft^2
Grab Tensile	ASTM D 4632	lbs	1/90,000 ft^2
Puncture	ASTM D 4833	lbs	1/90,000 ft^2
AOS, US Sieve	ASTM D 4751	mm	1/540,000 ft^2
Water Flow Rate	ASTM D 4491	gpm/ft^2	1/540,000 ft^2
UV Resistance	ASTM D 4355 (after 500 hours)	% retained	Once per resin formulation
Geocomposite Tests			
Ply Adhesion	GRI GC-7	lbs/ in	1/50,000 ft^2
Transmissivity	ASTM D 4716-00	m^2/sec	1/540,000 ft^2

PART 3 - EXECUTION

3 01 FAMILIARIZATION

A Inspection

1 Prior to implementing any of the work in the Section to be lined, the INSTALLER shall carefully inspect the installed work of all other Sections and verify that all work is complete to the point where the installation of the Section may properly commence without adverse impact

2 If the INSTALLER has any concerns regarding the installed work of other Sections, he shall notify the Project ENGINEER

3 02 MATERIAL PLACEMENT

A The geocomposite roll should be installed in the direction of the slope and in the intended direction of flow unless otherwise specified by the ENGINEER

B If the project contains long, steep slopes, special care should be taken so that only full length rolls are used at the top of the slope

C In the presence of wind, all geocomposites shall be weighted down with sandbags or the equivalent Such sandbags shall be used during placement and remain until replaced with cover material

D If the project includes an anchor trench at the top of the slopes, the geocomposite shall be properly anchored to resist sliding Anchor trench compacting equipment shall not come into direct contact with the geocomposite

E In applying fill material, no equipment can drive directly across the geocomposite The specified fill material shall be placed and spread utilizing vehicles with a low ground pressure

F The cover soil shall be placed in the geocomposite in a manner that prevents damage to the geocomposite Placement of the cover soil shall proceed immediately following the placement and inspection of the geocomposite

3 03 SEAMS AND OVERLAPS

A Each component of the geocomposite will be secured or seamed to the like component at overlaps

B Geonet Components
1 Adjacent edges of the geonet along the length of the geocomposite roll shall be placed with the edges of each geonet butted against each other
2 The overlaps shall be joined by tying the geonet structure with cable ties These ties shall be spaced every 5 feet along the roll length
3 Adjoining geocomposite rolls (end to end) across the roll width should be shingled down in the direction of the slope, with the geonet portion of the top overlapping the geonet portion of the bottom geocomposite a minimum of 12 inches across the roll width
4 The geonet portion should be tied every 6 inches in the anchor trench or as specified by the ENGINEER

3 04 REPAIR

A Prior to covering the deployed geocomposite, each roll shall be inspected for damage resulting from construction

B Any rips, tears or damaged areas on the deployed geocomposite shall be removed and patched The patch shall be secured to the original geonet by tying every 6 inches with the approved tying devices If the area to be repaired is more than 50 percent of the width of the panel, the damaged area shall be cut out and the two portions of the geonet shall be cut out and the two portions of the geonet shall be joined in accordance with Subsection 3 03

- END OF SECTION -

Geomembrane Installation Quality Assurance Manual

Table of Contents

Forms

1 0 Overview

ASTM Practices that this guide lists include the following

- ASTM D 6392 Standard Test Methods For Determining The Integrity Of Non-Reinforced Geomembrane Seams Produced Using Thermo Fusion Methods
- ASTM D 5820 Standard Practice For Pressurized Air Channel Evaluation of Dual Seamed Geomembranes
- ASTM D-5641 Standard Practice For Geomembrane Seam Evaluation By Vacuum Chamber
- ASTM D 6497 Standard Guide For Mechanical Attachment of Geomembrane to Penetrations or Structures

2 0 Material Delivery

2 01 Upon arrival on site the QA Consultant (QA) will do an inventory of materials on the job site

2 02 Roll numbers of liner textile geonet and composite will be logged on the Inventory Check List and cross-referenced with bills of lading

2 03 Any visible damage to roll materials should be noted on the roll and Inventory Check List

3 0 Earthwork

3 01 The General Contractor is responsible for preparing and maintaining the subgrade The subgrade should be prepared and maintained per the individual job specifications

3 02 Subgrade Surface Acceptance - The QA Site Manager shall be responsible for assuring that the subgrade surface has been properly prepared for deployment of geosynthetics

4 0 Panel Placement

4 01 Each panel will be assigned a number as detailed below

4 01a When there is only one layer panels may be designated with a number only i e 1 2, 3, 4 etc

4 01b When two or more layers are required use a letter and number i e Secondary Liner S1, S2, S3, S4 etc Primary Liner P1 P2 P3 P4 etc Tertiary Liner T1 T2 T3, T4 etc

4 02 This numbering system should be used whenever possible Agreement to a panel numbering system should be made at the pre construction meeting if possible

4 03 Panel numbers shall be written in large block letters in the center of each deployed panel The roll number date of deployment and length (gross) should be noted below the panel number All noting should be made so that they are easily visible from a distance On long panels it is beneficial to write information at both ends

4 04 Panel Numbers shall be logged on the Panel Placement Log along with the roll number and gross length

4 05 If there is a partial roll left after deployment it is important to write the last four digits of the roll number several times for future identification along with the estimated length

4 06 Deployment of geomembrane panels shall be performed in a manner that will comply with the following guidelines

4 06a Unroll geomembrane using methods that will not damage geomembrane and will protect underlying surface from damage (spreader bar, protected equipment bucket)

4 06b Place ballast (commonly sandbags) on geomembrane which will not damage geomembrane to prevent wind uplift

4 06c Personnel walking on geomembrane shall not engage in activities or wear shoes that could damage it Smoking will not be permitted on the geomembrane

4 06d Do not allow heavy vehicular traffic directly on geomembrane Rubber tired/tracked ATV's and trucks are acceptable if wheel contact is less than 8 psi

4 06e Protect geomembrane in areas of heavy traffic by placing protective cover over the geomembrane

4 06f Driver shall check for sharp edges, embedded rocks or other foreign material stuck into or protruding out from tires/tracks prior to driving on any geosynthetic layer

4 06g Path driven on geosynthetics shall be as straight as possible with no sharp turns sudden stops, or quick starts

4 06h Areas where driving occurs shall be continuously and thoroughly inspected throughout the deployment process by the contractor and the third party CQA

5 0 Trial Welds

5 01 Seaming apparatus shall be allowed to warm up a minimum of 15 minutes before performing trial welds

5 02 Each seaming apparatus along with the Welding Tech will pass a trial weld prior to use Trial welds to be performed in the morning and afternoon as a minimum as well as whenever there is a power shutdown

5 03 Fusion or wedge welds will always be performed or conducted on samples at least 6 long Extrusion welds will be done on samples at least 3' long

Note Always perform trial welds in the same conditions that exist on the job Run the trial welds on the ground, not the installed liner Do not use a wind break unless you are using one on the job

5 04 Sampling Procedure

5 04a Cut 4 1" wide specimens from the trial weld sample Operating temperatures should be monitored while welding

5 04b Specimens will always be cut using a 1" die cutter so the peel values may be used for qualitative analysis

5 04c When cutting coupons from the trial weld samples the inside and outside tracks on the coupon should be identified to assist in troubleshooting problems in case the weld fails The outside track will be defined as the track which would be peeled if pulling the overlap exposed in a typical installation or the seam which is closest to the edge of the top sheet The inside track is the seam closest to the edge of the bottom sheet

5 04d Place a small mark on the exposed (Top) overlap to denote the outside track prior to testing trial welds

5 05 Die Cutter

5 05a Only cut one sample at a time to avoid damaging the die cutter

5 05b Samples should be free of sand and grit prior to cutting sample

5 05c Inspect the die edge weekly for nicks dents or signs of dullness Dullness of the cutting edge may damage the units

5 05d Remove die when edge has been dulled and lightly reshape it with a medium hand file When wear is excessive return it for a replacement die

5 05e When the cuttıng board becomes deeply scored and/or ınterferes wıth coupon cuttıng ıt should be replaced

5 05d To adjust the depth of the dıe cut ınto the cuttıng board after replacıng the cuttıng board or sharpenıng the dıe 0 015 washer shıms can be added or removed between the cuttıng ram and the ram extensıon Only add shıms when cutting ıs dıffıcult due to lack of depth of cut

5 06 Trıal Weld Testıng

5 06a Allow coupons to cool prıor to testıng Avoıd separatıng the coupons whıle hot as faılure of the sheet may be ınıtıated and false readıngs ındıcated

5 06b In extreme heat the coupons may need to be cooled, usıng water or an ınsulated cooler prıor to peel testıng Lab condıtıons specıfy 70 degrees (plus or mınus 4 degrees) Fahrenheıt Coupon temperatures greater than 70 degrees may result ın lowered strengths

5 06c Vısually ınspect the coupons for squeeze-out, footprınt pressure and general appearance

5 06d Each of the 4 coupons wıll be tested ın peel on the fıeld tensıometer at a separatıon rate of 2" per mınute (for HDPE) Shear tests ın addıtıon to the peel tests, wıll be performed ıf requıred by a sıte specıfıc QA Plan

5 07 Pass/Faıl Crıterıa

5 07a Crıterıa for passıng trıal welds wıll be as follows

1) Seam must exhıbıt fılm tear bond (FTB) Trıal welds should have no ıncursıon ınto the weld

2) Peel and shear values shall meet or exceed the values lısted below for HDPE smooth or textured sheet (@ 2 /mın)

Mınımum Weld Values for HDPE Geomembranes

Property	Test Method	Thickness, mil (mm)					
		30 (0 75)	40 (1 0)	60 (1 5)	80 (2.0)	100 (2.5)	120 (3 0)
Peel Strength (fusıon) ppı (kN/m)	ASTM D 6392	49 (8 6)	65 (11 4)	98 (17 2)	130 (22 8)	162 (28 4)	196 (34 3)
Peel Strength (extrusıon) ppı (kN/m)	ASTM D 6392	39 (6 8)	52 (9 1)	78 (13 7)	104 (18 2)	130 (22 8)	157 (27 5)
Shear Strength (fusıon & ext) ppı (kN/m)	ASTM D 6392	61 (10 7)	81 (14 2)	121 (21 2)	162 (28 4)	203 (35 5)	242 (42 4)

5 07b Both tracks of fusıon welded samples must pass for the trıal weld to be consıdered acceptable If any of the four coupons faıl eıther due to seam ıncursıon (no FTB) or low strength values the trıal weld must be re done

5 07c The QA wıll gıve approval to proceed wıth weldıng after observıng and recordıng all trıal welds

5 08 Trıal Weld Documentatıon

5 08a All trıal weld data wıll be logged on the Trıal Weld log

5 08b When loggıng fusıon welded peel values on the Trıal Weld log ındıcate the values for the outsıde track fırst followed by the ınsıde track

5 08c Speed and temperature settıngs wıll be recorded for each machıne's trıal weld

6 0 Geomembrane Fıeld Seamıng

6 01 The seam number takes the ıdentıty of the panels on each sıde The seam between panels 1 & 2 becomes Seam 1/2 These lengths and seam numbers shall be recorded ın the Seam Log

6 02 Weldıng Technıcıans wıll mark theır ınıtıals/employee number machıne number date and tıme at the start of every seam Technıcıan should also perıodıcally mark temperatures along the seam and at the end of the seam

6 03 Approved processes for fıeld seamıng and repaırıng are extrusıon weldıng and fusıon weldıng All weldıng equıpment shall have accurate temperature monıtorıng devıces ınstalled and workıng to ensure proper measurement

6 04 Extrusion welding shall be used primarily for repairs patching and special detail fabricating and may be used for seaming The Site Manager shall verify that

1) equipment in use is functioning properly

2) welding personnel are purging the machine of heat degraded extrudate prior to actual use

3) all work is performed on clean surfaces and done in a professional manner

4) no seaming will be performed in adverse weather conditions

6 05 Fusion welding, shall be used for seaming panels together and is not used for patching or detail work The Site Manager shall verify that

1) the equipment used is functioning properly

2) seaming personnel are working in a professional manner and are attentive to their duties

3) no seaming will be performed in adverse weather conditions

6 06 Seam preparation the welding technician shall verify that

1) prior to seaming the seaming area is free of moisture dust dirt sand or debris of any nature

2) the seam is overlapped properly for fusion welding

3) the seam is overlapped or extended beyond damaged areas at least 4" when extrusion welding

4) the seam is properly heat tacked and abraded when extrusion welding

5) seams are welded with fewest number of unmatched wrinkles or "fishmouths"

6 07 No seaming will be performed in ambient air temperatures or adverse weather conditions that would jeopardize the integrity of the liner installation

7 0 Field Destructive Testing

7 01 Destructive seam tests shall be performed to evaluate bonded seam strength The frequency of sample removal shall be one sample per 500' of seam, unless specific site specifications differ Location of the destructive samples will be selected and marked by the QA Technician or third party QA Field testing should take place as soon as possible after seam is completed

7 02 Samples should be labeled in numerical order I e DS-1 DS 2 etc This should carry thru any layers and or multiple ponds do not start numbering from 1 again (This is the preferred method)

7 03 The size of samples and distribution should be approximately 12" x 25"(size may vary dependent on job requirements) and distributed as follows

7 03a 12" x 12" piece given to QA Technician for field testing

7 03b 12" x 12 piece given to third party for independent testing or archiving

NOTE All samples will be labeled showing test number seam number machine number, job number, date welded and welding tech number

7 04 The sample given to the QA Technician in the field shall have ten coupons cut and be tested with a tensiometer adjusted to a pull rate as shown below The strength of five out of five specimens should meet or exceed the values below

1) Seam must exhibit film tear bond (FTB) Welds should have ≤25% incursion into the weld

2) Peel and shear values shall meet or exceed the values listed below for HDPE smooth or textured sheet (@ 2"/min)

Minimum Weld Values for HDPE Geomembranes

Property	Test Method	Thickness, mil (mm)					
		30 (0 75)	40 (1.0)	60 (1 5)	80 (2 0)	100 (2.5)	120 (3.0)
Peel Strength (fusion) ppi (kN/m)	ASTM D 6392	49 (8 6)	65 (11 4)	98 (17 2)	130 (22 8)	162 (28 4)	196 (34 3)
Peel Strength (extrusion) ppi (kN/m)	ASTM D 6392	39 (6 8)	52 (9 1)	78 (13 7)	104 (18 2)	130 (22 8)	157 (27 5)
Shear Strength (fusion & ext) ppi (kN/m)	ASTM D 6392	61 (10 7)	81 (14 2)	121 (21 2)	162 (28 4)	203 (35 5)	242 (42 4)

7 05 All weld destructive test data will be logged on the Destructive Test Log

7 06 When logging fusion welded peel values on the Destructive Test Log, indicate the values for the outside track first, followed by the inside track

7 08 Test results will be noted in the Destructive Test Log as P (pass) or F (fail)

7 09 If test fails, additional samples will be cut, approximately 10 on each side of the failed test and retested These will be labeled A (after) & B (before) This procedure will repeat itself until a sample passes Then the area of failed seam between the two tests that pass will be capped or reconstructed

7 10 In lieu of taking an excessive number of samples the Site Manager may opt to extrusion weld the flap or cap the entire seam and then non destructively test according to Section 8 0

8 0 Non-Destructive Testing

8 01 All seams shall be non destructively tested their full length using an air pressure or vacuum test The purpose of this test is to check the continuity of the seam

8 02 Air testing, the following procedures are applicable to those seams welded with a double seam fusion welder

8 02a The equipment used shall consist of an air tank or pump capable of producing a minimum 35 psi and a sharp needle with a pressure gauge attached to insert into the air chamber

8 02b Seal both ends of the seam by heating and then squeezing together Insert the needle with the gauge into the air channel, it may be necessary to heat the liner to make this easier Pressurize the air channel to 30psi Note time test starts and wait a minimum of 5 minutes to check If pressure after five minutes has dropped less than 2 psi then the test is successful (thickness of material may cause variance)

8 02c Cut opposite seam end and listen for pressure release to verify full seam has been tested

8 02d If the test fails follow these procedures

a) While channel is under pressure walk the length of the seam listening for a leak

b) While channel is under pressure apply a soapy solution to the seam edge and look for bubbles formed by air escaping

c) Re-test the seam in smaller increments until the leak is found

8 02e Once the leak is found using one of the procedures above cut out the leak area and retest the portions of the seams between the leak areas as per 8 02a to 8 02c above Continue this procedure until all sections of the seam pass the pressure test

8 02f Repair the leak with a patch and vacuum test again

8 02g All non destructive tests will be noted in the Non Destructive Test/Repair log

8 03 Vacuum testing, the following procedures are applicable to those seams welded with a extrusion welder

8 03a The equipment used shall consist of an vacuum pumping device a vacuum box and a foaming agent in solution

8 03b Wet a section with the foaming agent place vacuum box over wetted area Evacuate air from the vacuum box to a pressure suitable to affect a seal between the box and geomembrane Observe the seam through the viewing window for the presence of soap bubbles emitting from the seam

8 03c If no bubbles are observed move box to the next area for testing If bubbles are observed, mark the area of the leak for repair as per Section 10 0 and retest as per Section 8 03

Note If vacuum testing fusion welded seams the overlap flap must be cut off to perform the tests

9 0 Defects and Repairs

9 01 Identification all seams and non seam areas of the geomembrane lining system shall be examined for defects in the seam and sheet

9 02 Identification of the defect should be made using the following procedures

9 02a For any defect in the seam or sheet that is an actual breach (hole) in the liner, installation personnel shall circle the defect and mark with the letter ' P along side the circle The letter "P indicates a patch is required

9 02b For any defect that is not an actual hole, installation personnel shall only circle the defect indicating that the repair method may be only an extruded bead and that a patch is not required

9 02c Each suspect area that has been identified as needing repair shall be repaired in accordance with this section and Non-Destructively tested as per Section 8 0 After all work is complete the Site Manager will conduct a final walkthrough to confirm all repairs have been completed and debris removed Only after this final evaluation by the Site Manager and Owner/Agent shall any material be placed over the installed liner

10 0 Repair Procedures

10 01 Any Portion of the Geomembrane liner system exhibiting a defect which has been marked for repair may be repaired with any one or combination of the following procedures

1) Patching - used to repair holes tears undispersed raw materials in the sheet and dented areas

2) Grind and Reweld used to repair small sections of extruded seams

3) Spot Welding - Used to repair small minor localized flaws

4) Flap Welding Used to extrusion weld the flap of a fusion weld in lieu of a full cap

5) Capping Used to repair failed seams

6) Topping - Application of extrudate bead directly to existing seams

10 02 The following conditions shall apply to the above methods

1) Surfaces of the geomembrane which are to be repaired shall be roughened

2) All surfaces must be clean and dry at the time of the repair

3) All seaming equipment used in repairing procedures shall be qualified

4) All patches and caps shall extend at least 4' beyond the edge of the defect and all patches must have rounded corners

5) All cut out holes in liner must have rounded corners 3" min radius

11 0 As-Built Drawing Procedures

11 01 Liner Layout

11 01a Submitted As-built Drawings should always be on blank outlines When outlines are not available plain paper may be used

11 01b Accuracy to the way seams fit or join

11 01c Using different colors makes information easier to see Drawings may be done in ink or pencil, but writing must be neat

11 01d Do not write so small that it is hard to read

11 01e Suggested scale is 1" = 40' (Other scales may be used if required)

11 02 Anchor Trenches

11 02a The amount of liner actually in the trench should be noted on the drawing If amount differs show all differences and approximate locations

11 02b If anchor trench is larger than shown on construction drawings then a written approval should be obtained from the Owner/Agent representative This should be included in the as built package

11 03 Panel & Roll Numbers

11 03a Each panel will be assigned a number as detailed below When there is only one layer panels may be designate with a number only, i e 1 2 3 4 etc

11 03b When two or more layers are required use a letter and number i e

Secondary Liner S1, S2 S3 S4 etc

Primary Liner P1 P2 P3 P4 etc

Tertiary Liner T1 T2 T3 T4 etc

11 03c This numbering system should be used whenever possible Agreement to a panel numbering system should be made at the pre construction meeting if possible

11 03d Panel numbers shall be written in large block letters in the center of each deployed panel The roll number, date of deployment and gross length should be noted below the panel number All notations should be made so that they are easily vis ible from a distance On long panels it is beneficial to write information at both ends

11 03e Whenever possible, roll numbers should be placed next to panel numbers on the field copies of the as built drawing

11 04 Seam Lengths

11 04a Every seam length that is not a cross seam must be noted This includes rectangles squares, pies and any other shape

11 04b It is assumed that all regular cross seams are either 22' or 34 wide unless they are not full width panels they do not have to be noted on the drawing Panel widths are measured perpendicularly across the panels

11 04c All dimensions should be called out in tenths of a foot

11 05 Tests

11 05a All test markings should conform to the "Legend on the blank outline

11 05b It can be assumed that all seam junctions will have a patch therefore it is only necessary to note if they don't

11 06 Seam Numbers

11 06a Since the seam number is drawn from the adjoining panels (I e 1/2 10/11 etc) there is no need to call out seam numbers on the drawings

11 07 Miscellaneous

11 07a QA's name should be on all drawings and paperwork

Forms

Inventory Check List

Date

Project **Site Manager**

Project # **QA Technician** **Page** of

Material	Roll #	Date Used	Material	Roll #	Date Used	Material	Roll #	Date Used	Material	Roll #	Date Used

Panel Placement Log

Project Name | Site Manager
Location | Material
Job Number | Sheet Thickness
Q A Technician | Smooth Textured

Panel Number	Roll Number	Deployment Date	Width (Feet)	Length (Feet)	Square Feet Smooth	Square Feet Textured

Trial Weld Log

Project Name

Location

Job Number

Q A Technician

Site Manager

Material

Sheet Thickness

Smooth Textured

Trial No	Date of Trial	Time of Trial	Technicians ID Number	Machine Number	Ambient Temp	Wedge Mass	Speed Preheat	Peel ppi	Peel ppi	Peel ppi	Peel ppi	Shear ppi	Shear ppi	Shear ppi	Shear ppi	FTB Y / N	Pass Fail

Seam Log

Project Name

Site Manager

Location

Material

Job Number

Sheet Thickness

Q A Technician

Smooth Textured

Seam Number	Time of Weld	Date of Weld	Type of Weld	Length of Seam	Machine Number	Technician ID Number

Destructive Test Log

Project Name	Site Manager	Fusion (ppi)	Extrusion (ppi)
Location	Material	Min Peel	Min Peel
Job Number	Sheet Thickness	Min Shear	Min Shear
Q A Technician	Smooth Textured		

Sample No	Date Welded	Seam Number	Technician ID Number	Machine Type & No	Location	Peel ppi	Peel ppi	Peel ppi	Peel ppi	Peel ppi	Shear ppi	Shear ppi	Shear ppi	Shear ppi	Shear ppi	FTB Y / N	Pass/ Fail

Non-Destuctive Test / Repair Log

Project Name

Location

Job Number

Q A Technician

Site Manager

Material

Sheet Thickness

Seam Number	Test Date	Technician ID Number	Test Type (A or V)	Air Pressure Test psi start	Air Pressure Test psi finish	Test Result (P or F)	Repair Locations

APPENDIX H
LEACHATE COLLECTION SYSTEM MODELING OUTPUT FILES AND CALCULATIONS

LEACHATE COLLECTION MODELING
OPEN CELL CASE

```
******************************************************************************
******************************************************************************
**                                                                          **
**                                                                          **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE               **
**                 HELP MODEL VERSION 3 07  (1 NOVEMBER 1997)               **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY                   **
**                    USAE WATERWAYS EXPERIMENT STATION                     **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY              **
**                                                                          **
**                                                                          **
******************************************************************************
******************************************************************************


PRECIPITATION DATA FILE      x \shire\help\proprecp D4
TEMPERATURE DATA FILE        x \shire\help\protemp D7
SOLAR RADIATION DATA FILE    x \shire\help\prosolar D13
EVAPOTRANSPIRATION DATA      x \shire\help\evapo12 D11
SOIL AND DESIGN DATA FILE    x \shire\help\peaknoco D10
OUTPUT DATA FILE             x \shire\help\penocoot OUT


TIME   14 29     DATE    8/ 6/2003


******************************************************************************

     TITLE   Open Closed Cell

******************************************************************************


     NOTE   INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE
              COMPUTED AS NEARLY STEADY-STATE VALUES BY THE PROGRAM


                                  LAYER  1
                                  --------

                      TYPE 1 - VERTICAL PERCOLATION LAYER
                          MATERIAL TEXTURE NUMBER   0
           THICKNESS                    =      12 00   INCHES
           POROSITY                     =       0 3980 VOL/VOL
           FIELD CAPACITY               =       0 2440 VOL/VOL
           WILTING POINT                =       0 1360 VOL/VOL
           INITIAL SOIL WATER CONTENT   =       0 2048 VOL/VOL
           EFFECTIVE SAT  HYD  COND     =  0 999999975000E-05 CM/SEC
```

LAYER 2

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 18

```
THICKNESS                  =    180 00   INCHES
POROSITY                   =      0 6710 VOL/VOL
FIELD CAPACITY             =      0 2920 VOL/VOL
WILTING POINT              =      0 0770 VOL/VOL
INITIAL SOIL WATER CONTENT =      0 2920 VOL/VOL
EFFECTIVE SAT  HYD  COND   =  0 100000005000E-02 CM/SEC
```

LAYER 3

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 0

```
THICKNESS                  =     12 00   INCHES
POROSITY                   =      0 3980 VOL/VOL
FIELD CAPACITY             =      0 2440 VOL/VOL
WILTING POINT              =      0 1360 VOL/VOL
INITIAL SOIL WATER CONTENT =      0 2440 VOL/VOL
EFFECTIVE SAT  HYD  COND   =  0 999999975000E-05 CM/SEC
```

LAYER 4

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 18

```
THICKNESS                  =    180 00   INCHES
POROSITY                   =      0 6710 VOL/VOL
FIELD CAPACITY             =      0 2920 VOL/VOL
WILTING POINT              =      0 0770 VOL/VOL
INITIAL SOIL WATER CONTENT =      0 2920 VOL/VOL
EFFECTIVE SAT  HYD  COND   =  0 100000005000E-02 CM/SEC
```

LAYER 5

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 0

```
THICKNESS                  =     12 00   INCHES
POROSITY                   =      0 3980 VOL/VOL
FIELD CAPACITY             =      0 2440 VOL/VOL
WILTING POINT              =      0 1360 VOL/VOL
INITIAL SOIL WATER CONTENT =      0 2440 VOL/VOL
```

```
EFFECTIVE SAT  HYD  COND     =  0 999999975000E-05 CM/SEC
```

LAYER 6

```
          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  18
THICKNESS                    =     180 00    INCHES
POROSITY                     =       0 6710 VOL/VOL
FIELD CAPACITY               =       0 2920 VOL/VOL
WILTING POINT                =       0 0770 VOL/VOL
INITIAL SOIL WATER CONTENT   =       0 2920 VOL/VOL
EFFECTIVE SAT  HYD  COND     =  0 100000005000E-02 CM/SEC
```

LAYER 7

```
          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   0
THICKNESS                    =      12 00    INCHES
POROSITY                     =       0 3980 VOL/VOL
FIELD CAPACITY               =       0 2440 VOL/VOL
WILTING POINT                =       0 1360 VOL/VOL
INITIAL SOIL WATER CONTENT   =       0 2440 VOL/VOL
EFFECTIVE SAT  HYD  COND     =  0 999999975000E-05 CM/SEC
```

LAYER 8

```
          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  18
THICKNESS                    =     180 00    INCHES
POROSITY                     =       0 6710 VOL/VOL
FIELD CAPACITY               =       0 2920 VOL/VOL
WILTING POINT                =       0 0770 VOL/VOL
INITIAL SOIL WATER CONTENT   =       0 2920 VOL/VOL
EFFECTIVE SAT  HYD  COND     =  0 100000005000E-02 CM/SEC
```

LAYER 9

```
          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   0
THICKNESS                    =      12 00    INCHES
POROSITY                     =       0 3980 VOL/VOL
```

```
FIELD CAPACITY               =      0 2440 VOL/VOL
WILTING POINT                =      0 1360 VOL/VOL
INITIAL SOIL WATER CONTENT   =      0 2440 VOL/VOL
EFFECTIVE SAT  HYD  COND     =  0 999999975000E-05 CM/SEC


                        LAYER 10
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  18
THICKNESS                    =    180 00    INCHES
POROSITY                     =      0 6710 VOL/VOL
FIELD CAPACITY               =      0 2920 VOL/VOL
WILTING POINT                =      0 0770 VOL/VOL
INITIAL SOIL WATER CONTENT   =      0 2920 VOL/VOL
EFFECTIVE SAT  HYD  COND     =  0 100000005000E-02 CM/SEC


                        LAYER 11
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   0
THICKNESS                    =     12 00    INCHES
POROSITY                     =      0 3980 VOL/VOL
FIELD CAPACITY               =      0 2440 VOL/VOL
WILTING POINT                =      0 1360 VOL/VOL
INITIAL SOIL WATER CONTENT   =      0 2460 VOL/VOL
EFFECTIVE SAT  HYD  COND     =  0 999999975000E-05 CM/SEC


                        LAYER 12
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  18
THICKNESS                    =    180 00    INCHES
POROSITY                     =      0 6710 VOL/VOL
FIELD CAPACITY               =      0 2920 VOL/VOL
WILTING POINT                =      0 0770 VOL/VOL
INITIAL SOIL WATER CONTENT   =      0 2920 VOL/VOL
EFFECTIVE SAT  HYD  COND     =  0 100000005000E-02 CM/SEC


                        LAYER 13
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
```

```
              MATERIAL TEXTURE NUMBER   0
THICKNESS                     =     12 00   INCHES
POROSITY                      =      0 3980 VOL/VOL
FIELD CAPACITY                =      0 2440 VOL/VOL
WILTING POINT                 =      0 1360 VOL/VOL
INITIAL SOIL WATER CONTENT    =      0 2440 VOL/VOL
EFFECTIVE SAT  HYD  COND      =  0 999999975000E-05 CM/SEC


                        LAYER 14
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  18
THICKNESS                     =    180 00   INCHES
POROSITY                      =      0 6710 VOL/VOL
FIELD CAPACITY                =      0 2920 VOL/VOL
WILTING POINT                 =      0 0770 VOL/VOL
INITIAL SOIL WATER CONTENT    =      0 2920 VOL/VOL
EFFECTIVE SAT  HYD  COND      =  0 100000005000E-02 CM/SEC


                        LAYER 15
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   0
THICKNESS                     =     12 00   INCHES
POROSITY                      =      0 3980 VOL/VOL
FIELD CAPACITY                =      0 2440 VOL/VOL
WILTING POINT                 =      0 1360 VOL/VOL
INITIAL SOIL WATER CONTENT    =      0 2440 VOL/VOL
EFFECTIVE SAT  HYD  COND      =  0 999999975000E-05 CM/SEC


                        LAYER 16
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  18
THICKNESS                     =    180 00   INCHES
POROSITY                      =      0 6710 VOL/VOL
FIELD CAPACITY                =      0 2920 VOL/VOL
WILTING POINT                 =      0 0770 VOL/VOL
INITIAL SOIL WATER CONTENT    =      0 2920 VOL/VOL
EFFECTIVE SAT  HYD  COND      =  0 100000005000E-02 CM/SEC


                        LAYER 17
```

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	12 00 INCHES
POROSITY	=	0 3980 VOL/VOL
FIELD CAPACITY	=	0 2440 VOL/VOL
WILTING POINT	=	0 1360 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0 2440 VOL/VOL
EFFECTIVE SAT HYD COND	=	0 999999975000E-05 CM/SEC

LAYER 18

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 18

THICKNESS	=	180 00 INCHES
POROSITY	=	0 6710 VOL/VOL
FIELD CAPACITY	=	0 2920 VOL/VOL
WILTING POINT	=	0 0770 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0 2920 VOL/VOL
EFFECTIVE SAT HYD COND	=	0 100000005000E-02 CM/SEC

LAYER 19

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	24 00 INCHES
POROSITY	=	0 3970 VOL/VOL
FIELD CAPACITY	=	0 0320 VOL/VOL
WILTING POINT	=	0 0130 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0 0320 VOL/VOL
EFFECTIVE SAT HYD COND	=	1 00000000000 CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED

SCS RUNOFF CURVE NUMBER	=	79 00	
FRACTION OF AREA ALLOWING RUNOFF	=	100 0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1000 000	ACRES
EVAPORATIVE ZONE DEPTH	=	12 0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	2 458	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4 776	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1 632	INCHES

INITIAL SNOW WATER = 0 000 INCHES
INITIAL WATER IN LAYER MATERIALS = 499 713 INCHES
TOTAL INITIAL WATER = 499 713 INCHES
TOTAL SUBSURFACE INFLOW = 0 00 INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
SALT LAKE CITY UTAH

STATION LATITUDE = 40 76 DEGREES
MAXIMUM LEAF AREA INDEX = 1 60
START OF GROWING SEASON (JULIAN DATE) = 117
END OF GROWING SEASON (JULIAN DATE) = 289
EVAPORATIVE ZONE DEPTH = 12 0 INCHES
AVERAGE ANNUAL WIND SPEED = 8 80 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY = 67 00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY = 48 00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY = 39 00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY = 65 00 %

NOTE PRECIPITATION DATA FOR Bear River Refuge Utah
WAS ENTERED BY THE USER

NOTE TEMPERATURE DATA FOR Salt Lake City Utah
WAS ENTERED BY THE USER

NOTE SOLAR RADIATION DATA FOR Salt Lake City Utah
WAS ENTERED BY THE USER

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 004	0 002	0 006	0 000	0 000	0 000
	0 001	0 000	0 000	0 016	0 000	0 000
EVAPOTRANSPIRATION	0 761	0 771	2 912	1 257	2 700	1 740

	0 450	0 049	0 160	1 583	0 704	0 229
PERCOLATION/LEAKAGE THROUGH	0 0018	0 0001	0 0013	0 0024	0 0010	0 0007
LAYER 19	0 0000	0 0003	0 0018	0 0063	0 0057	0 0053

****

****

ANNUAL TOTALS FOR YEAR 1

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	48496820 000	100 00
RUNOFF	0 028	103158 656	0 21
EVAPOTRANSPIRATION	13 316	48336656 000	99 67
PERC /LEAKAGE THROUGH LAYER 19	0 026608	96585 367	0 20
CHANGE IN WATER STORAGE	-0 011	-39548 035	-0 08
SOIL WATER AT START OF YEAR	499 713	*************	
SOIL WATER AT END OF YEAR	499 702	*************	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	0 0000	-30 602	0 00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 2

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 004	0 002	0 005	0 000	0 000	0 000
	0 000	0 000	0 000	0 016	0 000	0 000
EVAPOTRANSPIRATION	0 759	0 771	2 809	1 257	2 740	1 740

	0 450	0 049	0 160	1 580	0 704	0 229
PERCOLATION/LEAKAGE THROUGH	0 0001	0 0000	0 0010	0 0035	0 0036	0 0003
LAYER 19	0 0040	0 0000	0 0020	0 0017	0 0017	0 0008

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ANNUAL TOTALS FOR YEAR 2

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	48496820 000	100 00
RUNOFF	0 027	98791 867	0 20
EVAPOTRANSPIRATION	13 249	48092928 000	99 17
PERC /LEAKAGE THROUGH LAYER 19	0 018768	68129 031	0 14
CHANGE IN WATER STORAGE	0 065	237288 203	0 49
SOIL WATER AT START OF YEAR	499 702	*************	
SOIL WATER AT END OF YEAR	499 767	*************	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	-0 0001	-316 494	0 00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 3

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 004	0 001	0 006	0 000	0 000	0 000
	0 000	0 000	0 000	0 016	0 000	0 000
EVAPOTRANSPIRATION	0 789	0 784	2 706	1 257	2 741	1 740

	0 450	0 049	0 160	1 579	0 704	0 229
PERCOLATION/LEAKAGE THROUGH LAYER 19	0 0031	0 0024	0 0001	0 0023	0 0022	0 0036
	0 0022	0 0024	0 0012	0 0040	0 0036	0 0013

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ANNUAL TOTALS FOR YEAR 3

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	48496820 000	100 00
RUNOFF	0 027	98389 516	0 20
EVAPOTRANSPIRATION	13 188	47874060 000	98 72
PERC /LEAKAGE THROUGH LAYER 19	0 028447	103263 742	0 21
CHANGE IN WATER STORAGE	0 116	420627 125	0 87
SOIL WATER AT START OF YEAR	499 767	*************	
SOIL WATER AT END OF YEAR	499 883	*************	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	0 0001	479 992	0 00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 4

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 004	0 001	0 005	0 000	0 000	0 000
	0 000	0 000	0 000	0 016	0 000	0 000
EVAPOTRANSPIRATION	0 789	0 796	2 936	1 230	2 666	1 740

	0 472	0 028	0 164	1 599	0 692	0 217
PERCOLATION/LEAKAGE THROUGH	0 0008	0 0010	0 0045	0 0037	0 0026	0 0020
LAYER 19	0 0000	0 0010	0 0049	0 0050	0 0022	0 0015

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ANNUAL TOTALS FOR YEAR 4

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	48496820 000	100 00
RUNOFF	0 027	97258 320	0 20
EVAPOTRANSPIRATION	13 329	48382940 000	99 77
PERC /LEAKAGE THROUGH LAYER 19	0 029086	105583 836	0 22
CHANGE IN WATER STORAGE	-0 025	-88955 383	-0 18
SOIL WATER AT START OF YEAR	499 883	*************	
SOIL WATER AT END OF YEAR	499 859	*************	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	0 0000	-6 160	0 00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 5

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 004	0 001	0 006	0 000	0 000	0 000
	0 000	0 000	0 000	0 016	0 000	0 000
EVAPOTRANSPIRATION	0 790	0 784	2 706	1 257	2 742	1 740

	0 450	0 049	0 160	1 579	0 704	0 229
PERCOLATION/LEAKAGE THROUGH LAYER 19	0 0001	0 0000	0 0014	0 0039	0 0014	0 0048
	0 0086	0 0105	0 0063	0 0063	0 0043	0 0043

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ANNUAL TOTALS FOR YEAR 5

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	48496820 000	100 00
RUNOFF	0 027	98490 187	0 20
EVAPOTRANSPIRATION	13 191	47883716 000	98 74
PERC /LEAKAGE THROUGH LAYER 19	0 052003	188771 750	0 39
CHANGE IN WATER STORAGE	0 090	326132 812	0 67
SOIL WATER AT START OF YEAR	499 859	*************	
SOIL WATER AT END OF YEAR	499 949	*************	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	-0 0001	-289 442	0 00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 6

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 004	0 001	0 006	0 000	0 000	0 000
	0 000	0 000	0 000	0 016	0 000	0 000
EVAPOTRANSPIRATION	0 789	0 784	2 706	1 257	2 740	1 740

	0 450	0 049	0 160	1 579	0 704	0 229
PERCOLATION/LEAKAGE THROUGH	0 0072	0 0078	0 0040	0 0045	0 0042	0 0036
LAYER 19	0 0067	0 0072	0 0058	0 0053	0 0019	0 0002

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ANNUAL TOTALS FOR YEAR 6

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	48496820 000	100 00
RUNOFF	0 027	98367 797	0 20
EVAPOTRANSPIRATION	13 187	47869304 000	98 71
PERC /LEAKAGE THROUGH LAYER 19	0 058307	211655 641	0 44
CHANGE IN WATER STORAGE	0 087	317159 719	0 65
SOIL WATER AT START OF YEAR	499 949	*************	
SOIL WATER AT END OF YEAR	500 036	*************	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	0 0001	333 783	0 00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 7

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 004	0 001	0 006	0 000	0 000	0 000
	0 000	0 000	0 000	0 016	0 000	0 000
EVAPOTRANSPIRATION	0 789	0 784	2 705	1 257	2 721	1 740

	0 451	0 049	0 160	1 578	0 703	0 229
PERCOLATION/LEAKAGE THROUGH	0 0000	0 0000	0 0006	0 0017	0 0075	0 0115
LAYER 19	0 0139	0 0102	0 0077	0 0096	0 0108	0 0104

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ANNUAL TOTALS FOR YEAR 7

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	48496820 000	100 00
RUNOFF	0 027	98300 937	0 20
EVAPOTRANSPIRATION	13 167	47797528 000	98 56
PERC /LEAKAGE THROUGH LAYER 19	0 083856	304397 625	0 63
CHANGE IN WATER STORAGE	0 082	296665 656	0 61
SOIL WATER AT START OF YEAR	500 036	*************	
SOIL WATER AT END OF YEAR	500 118	*************	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	0 0000	-72 996	0 00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 8

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 004	0 001	0 005	0 000	0 000	0 000
	0 000	0 000	0 000	0 016	0 000	0 000
EVAPOTRANSPIRATION	0 789	0 796	2 935	1 230	2 667	1 740

	0 472	0 028	0 164	1 599	0 692	0 217
PERCOLATION/LEAKAGE THROUGH LAYER 19	0 0072	0 0029	0 0039	0 0060	0 0078	0 0076
	0 0066	0 0052	0 0024	0 0022	0 0000	0 0000

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ANNUAL TOTALS FOR YEAR 8

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	48496820 000	100 00
RUNOFF	0 027	97298 375	0 20
EVAPOTRANSPIRATION	13 329	48386068 000	99 77
PERC /LEAKAGE THROUGH LAYER 19	0 051852	188221 687	0 39
CHANGE IN WATER STORAGE	-0 048	-174919 734	-0 36
SOIL WATER AT START OF YEAR	500 118	*************	
SOIL WATER AT END OF YEAR	500 070	*************	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	0 0000	150 793	0 00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 9

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 004	0 001	0 006	0 000	0 000	0 000
	0 000	0 000	0 000	0 016	0 000	0 000
EVAPOTRANSPIRATION	0 790	0 784	2 706	1 257	2 742	1 740

	0 450	0 049	0 160	1 579	0 704	0 229
PERCOLATION/LEAKAGE THROUGH	0 0000	0 0027	0 0091	0 0079	0 0105	0 0127
LAYER 19	0 0107	0 0090	0 0090	0 0104	0 0094	0 0054

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ANNUAL TOTALS FOR YEAR 9

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	48496820 000	100 00
RUNOFF	0 027	98209 000	0 20
EVAPOTRANSPIRATION	13 191	47882256 000	98 73
PERC /LEAKAGE THROUGH LAYER 19	0 096815	351438 437	0 72
CHANGE IN WATER STORAGE	0 045	164949 641	0 34
SOIL WATER AT START OF YEAR	500 070	*************	
SOIL WATER AT END OF YEAR	500 115	*************	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	0 0000	-34 321	0 00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 10

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 004	0 001	0 005	0 000	0 000	0 000
	0 000	0 000	0 000	0 016	0 000	0 000
EVAPOTRANSPIRATION	0 789	0 784	2 906	1 257	2 682	1 740

	0 450	0 049	0 160	1 580	0 704	0 229
PERCOLATION/LEAKAGE THROUGH	0 0000	0 0008	0 0040	0 0038	0 0065	0 0136
LAYER 19	0 0134	0 0104	0 0147	0 0108	0 0117	0 0086

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ANNUAL TOTALS FOR YEAR 10

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	48496820 000	100 00
RUNOFF	0 027	97187 914	0 20
EVAPOTRANSPIRATION	13 331	48390264 000	99 78
PERC /LEAKAGE THROUGH LAYER 19	0 098232	356582 562	0 74
CHANGE IN WATER STORAGE	-0 096	-347291 562	-0 72
SOIL WATER AT START OF YEAR	500 115	*************	
SOIL WATER AT END OF YEAR	500 019	*************	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	0 0000	76 458	0 00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 11

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 004	0 001	0 006	0 000	0 000	0 000
	0 000	0 000	0 000	0 016	0 000	0 000
EVAPOTRANSPIRATION	0 789	0 784	2 706	1 257	2 739	1 740

	0 450	0 049	0 160	1 579	0 704	0 229
PERCOLATION/LEAKAGE THROUGH	0 0059	0 0046	0 0067	0 0085	0 0087	0 0104
LAYER 19	0 0099	0 0080	0 0065	0 0016	0 0000	0 0000

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ANNUAL TOTALS FOR YEAR 11

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	48496820 000	100 00
RUNOFF	0 027	98400 773	0 20
EVAPOTRANSPIRATION	13 186	47866760 000	98 70
PERC /LEAKAGE THROUGH LAYER 19	0 070838	257140 391	0 53
CHANGE IN WATER STORAGE	0 076	274620 656	0 57
SOIL WATER AT START OF YEAR	500 019	*************	
SOIL WATER AT END OF YEAR	500 095	*************	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	0 0000	-103 882	0 00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 12

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 004	0 001	0 005	0 000	0 000	0 000
	0 000	0 000	0 000	0 016	0 000	0 000
EVAPOTRANSPIRATION	0 789	0 796	2 936	1 230	2 667	1 740

	0 472	0 028	0 164	1 599	0 692	0 217
PERCOLATION/LEAKAGE THROUGH LAYER 19	0 0000	0 0028	0 0084	0 0169	0 0164	0 0102
	0 0113	0 0124	0 0115	0 0090	0 0048	0 0031

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ANNUAL TOTALS FOR YEAR 12

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	48496820 000	100 00
RUNOFF	0 027	97246 242	0 20
EVAPOTRANSPIRATION	13 329	48385984 000	99 77
PERC /LEAKAGE THROUGH LAYER 19	0 106830	387793 656	0 80
CHANGE IN WATER STORAGE	-0 103	-374321 594	-0 77
SOIL WATER AT START OF YEAR	500 095	*************	
SOIL WATER AT END OF YEAR	499 992	*************	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	0 0000	115 890	0 00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 13

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 004	0 001	0 006	0 000	0 000	0 000
	0 000	0 000	0 000	0 016	0 000	0 000
EVAPOTRANSPIRATION	0 790	0 784	2 706	1 257	2 742	1 740

	0 450	0 049	0 160	1 579	0 704	0 229
PERCOLATION/LEAKAGE THROUGH	0 0018	0 0052	0 0122	0 0163	0 0204	0 0108
LAYER 19	0 0194	0 0201	0 0139	0 0132	0 0105	0 0092

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ANNUAL TOTALS FOR YEAR 13

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	48496820 000	100 00
RUNOFF	0 027	98349 969	0 20
EVAPOTRANSPIRATION	13 190	47880584 000	98 73
PERC /LEAKAGE THROUGH LAYER 19	0 153102	555761 250	1 15
CHANGE IN WATER STORAGE	-0 010	-37664 797	-0 08
SOIL WATER AT START OF YEAR	499 992	*************	
SOIL WATER AT END OF YEAR	499 981	*************	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	-0 0001	-211 605	0 00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 14

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 004	0 001	0 005	0 000	0 000	0 000
	0 000	0 000	0 000	0 016	0 000	0 000
EVAPOTRANSPIRATION	0 789	0 784	2 906	1 257	2 681	1 740

	0 450	0 049	0 160	1 580	0 704	0 229
PERCOLATION/LEAKAGE THROUGH	0 0115	0 0111	0 0087	0 0054	0 0080	0 0043
LAYER 19	0 0061	0 0084	0 0080	0 0068	0 0055	0 0022

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ANNUAL TOTALS FOR YEAR 14

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	48496820 000	100 00
RUNOFF	0 027	97245 797	0 20
EVAPOTRANSPIRATION	13 330	48386600 000	99 77
PERC /LEAKAGE THROUGH LAYER 19	0 085856	311656 437	0 64
CHANGE IN WATER STORAGE	-0 082	-298881 219	-0 62
SOIL WATER AT START OF YEAR	499 981	*************	
SOIL WATER AT END OF YEAR	499 899	*************	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	0 0001	197 000	0 00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 15

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 004	0 001	0 006	0 000	0 000	0 000
	0 000	0 000	0 000	0 016	0 000	0 000
EVAPOTRANSPIRATION	0 789	0 784	2 706	1 257	2 741	1 740

	0 450	0 049	0 160	1 579	0 704	0 229
PERCOLATION/LEAKAGE THROUGH	0 0000	0 0000	0 0000	0 0018	0 0072	0 0120
LAYER 19	0 0148	0 0141	0 0085	0 0082	0 0083	0 0074

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ANNUAL TOTALS FOR YEAR 15

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	48496820 000	100 00
RUNOFF	0 027	98393 641	0 20
EVAPOTRANSPIRATION	13 188	47873868 000	98 72
PERC /LEAKAGE THROUGH LAYER 19	0 082384	299053 375	0 62
CHANGE IN WATER STORAGE	0 062	225767 219	0 47
SOIL WATER AT START OF YEAR	499 899	*************	
SOIL WATER AT END OF YEAR	499 961	*************	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	-0 0001	-263 451	0 00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 16

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 004	0 001	0 005	0 000	0 000	0 000
	0 000	0 000	0 000	0 016	0 000	0 000
EVAPOTRANSPIRATION	0 789	0 796	2 936	1 230	2 666	1 740

	0 472	0 028	0 164	1 599	0 692	0 217
PERCOLATION/LEAKAGE THROUGH	0 0093	0 0089	0 0034	0 0067	0 0074	0 0034
LAYER 19	0 0045	0 0068	0 0066	0 0055	0 0035	0 0012

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ANNUAL TOTALS FOR YEAR 16

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	48496820 000	100 00
RUNOFF	0 027	97267 094	0 20
EVAPOTRANSPIRATION	13 329	48385760 000	99 77
PERC /LEAKAGE THROUGH LAYER 19	0 067191	243904 328	0 50
CHANGE IN WATER STORAGE	-0 063	-230419 922	-0 48
SOIL WATER AT START OF YEAR	499 961	*************	
SOIL WATER AT END OF YEAR	499 898	*************	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	0 0001	307 725	0 00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 17

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 004	0 001	0 006	0 000	0 000	0 000
	0 000	0 000	0 000	0 016	0 000	0 000
EVAPOTRANSPIRATION	0 790	0 784	2 706	1 257	2 714	1 740

	0 450	0 049	0 160	1 580	0 704	0 229
PERCOLATION/LEAKAGE THROUGH LAYER 19	0 0000	0 0000	0 0002	0 0042	0 0072	0 0111
	0 0140	0 0140	0 0089	0 0074	0 0077	0 0088

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ANNUAL TOTALS FOR YEAR 17

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	48496820 000	100 00
RUNOFF	0 027	98606 234	0 20
EVAPOTRANSPIRATION	13 163	47782972 000	98 53
PERC /LEAKAGE THROUGH LAYER 19	0 083334	302502 031	0 62
CHANGE IN WATER STORAGE	0 086	312839 344	0 65
SOIL WATER AT START OF YEAR	499 898	*************	
SOIL WATER AT END OF YEAR	499 984	*************	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	0 0000	-99 366	0 00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 18

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 004	0 001	0 006	0 000	0 000	0 000
	0 000	0 000	0 000	0 016	0 000	0 000
EVAPOTRANSPIRATION	0 789	0 784	2 706	1 257	2 741	1 740

	0 451	0 049	0 160	1 578	0 704	0 229
PERCOLATION/LEAKAGE THROUGH	0 0078	0 0080	0 0039	0 0065	0 0048	0 0045
LAYER 19	0 0073	0 0073	0 0058	0 0054	0 0014	0 0002

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ANNUAL TOTALS FOR YEAR 18

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	48496820 000	100 00
RUNOFF	0 027	98297 641	0 20
EVAPOTRANSPIRATION	13 188	47872596 000	98 71
PERC /LEAKAGE THROUGH LAYER 19	0 062766	227841 016	0 47
CHANGE IN WATER STORAGE	0 082	297995 000	0 61
SOIL WATER AT START OF YEAR	499 984	*************	
SOIL WATER AT END OF YEAR	500 066	*************	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	0 0000	91 090	0 00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 19

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 004	0 001	0 005	0 000	0 000	0 000
	0 000	0 000	0 000	0 016	0 000	0 000
EVAPOTRANSPIRATION	0 789	0 784	2 906	1 257	2 682	1 740

	0 450	0 049	0 160	1 580	0 704	0 229
PERCOLATION/LEAKAGE THROUGH	0 0000	0 0001	0 0007	0 0039	0 0103	0 0121
LAYER 19	0 0103	0 0086	0 0092	0 0123	0 0086	0 0076

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ANNUAL TOTALS FOR YEAR 19

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	48496820 000	100 00
RUNOFF	0 027	97299 555	0 20
EVAPOTRANSPIRATION	13 330	48386700 000	99 77
PERC /LEAKAGE THROUGH LAYER 19	0 083627	303566 094	0 63
CHANGE IN WATER STORAGE	-0 080	-290794 375	-0 60
SOIL WATER AT START OF YEAR	500 066	*************	
SOIL WATER AT END OF YEAR	499 986	*************	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	0 0000	46 329	0 00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 20

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 004	0 001	0 006	0 000	0 000	0 000
	0 000	0 000	0 000	0 016	0 000	0 000
EVAPOTRANSPIRATION	0 789	0 796	2 735	1 230	2 727	1 740

	0 472	0 028	0 165	1 597	0 692	0 217
PERCOLATION/LEAKAGE THROUGH	0 0068	0 0028	0 0050	0 0087	0 0095	0 0066
LAYER 19	0 0040	0 0059	0 0051	0 0001	0 0000	0 0006

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ANNUAL TOTALS FOR YEAR 20

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	48496820 000	100 00
RUNOFF	0 027	98404 219	0 20
EVAPOTRANSPIRATION	13 189	47874500 000	98 72
PERC /LEAKAGE THROUGH LAYER 19	0 055129	200117 047	0 41
CHANGE IN WATER STORAGE	0 089	323806 469	0 67
SOIL WATER AT START OF YEAR	499 986	*************	
SOIL WATER AT END OF YEAR	500 075	*************	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	0 0000	-7 005	0 00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 21

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 004	0 001	0 006	0 000	0 000	0 000
	0 000	0 000	0 000	0 016	0 000	0 000
EVAPOTRANSPIRATION	0 789	0 784	2 706	1 257	2 742	1 740

	0 451	0 049	0 160	1 579	0 704	0 229
PERCOLATION/LEAKAGE THROUGH LAYER 19	0 0069	0 0065	0 0079	0 0094	0 0132	0 0078
	0 0086	0 0110	0 0089	0 0070	0 0045	0 0052

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ANNUAL TOTALS FOR YEAR 21

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	48496820 000	100 00
RUNOFF	0 027	98300 211	0 20
EVAPOTRANSPIRATION	13 190	47880544 000	98 73
PERC /LEAKAGE THROUGH LAYER 19	0 097094	352451 312	0 73
CHANGE IN WATER STORAGE	0 046	165503 547	0 34
SOIL WATER AT START OF YEAR	500 075	*************	
SOIL WATER AT END OF YEAR	500 121	*************	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	0 0000	21 312	0 00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 22

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 004	0 001	0 005	0 000	0 000	0 000
	0 001	0 000	0 000	0 016	0 000	0 000
EVAPOTRANSPIRATION	0 789	0 784	2 906	1 257	2 657	1 740

	0 450	0 049	0 160	1 581	0 704	0 229
PERCOLATION/LEAKAGE THROUGH	0 0016	0 0042	0 0057	0 0079	0 0078	0 0071
LAYER 19	0 0066	0 0032	0 0000	0 0003	0 0045	0 0018

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ANNUAL TOTALS FOR YEAR 22

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	48496820 000	100 00
RUNOFF	0 027	97372 555	0 20
EVAPOTRANSPIRATION	13 306	48299420 000	99 59
PERC /LEAKAGE THROUGH LAYER 19	0 050430	183061 047	0 38
CHANGE IN WATER STORAGE	-0 023	-83084 109	-0 17
SOIL WATER AT START OF YEAR	500 121	*************	
SOIL WATER AT END OF YEAR	500 098	*************	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	0 0000	51 414	0 00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 23

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 004	0 001	0 006	0 000	0 000	0 000
	0 000	0 000	0 000	0 016	0 000	0 000
EVAPOTRANSPIRATION	0 789	0 784	2 706	1 257	2 739	1 740

	0 450	0 049	0 160	1 579	0 704	0 229
PERCOLATION/LEAKAGE THROUGH LAYER 19	0 0013	0 0039	0 0071	0 0095	0 0112	0 0178
	0 0186	0 0134	0 0115	0 0127	0 0127	0 0094

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ANNUAL TOTALS FOR YEAR 23

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	48496820 000	100 00
RUNOFF	0 027	98474 156	0 20
EVAPOTRANSPIRATION	13 187	47870040 000	98 71
PERC /LEAKAGE THROUGH LAYER 19	0 128891	467874 906	0 96
CHANGE IN WATER STORAGE	0 017	60374 449	0 12
SOIL WATER AT START OF YEAR	500 098	*************	
SOIL WATER AT END OF YEAR	500 115	*************	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	0 0000	56 093	0 00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 24

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 004	0 001	0 006	0 000	0 000	0 000
	0 000	0 000	0 000	0 016	0 000	0 000
EVAPOTRANSPIRATION	0 789	0 796	2 735	1 230	2 725	1 740

	0 472	0 028	0 165	1 597	0 692	0 217
PERCOLATION/LEAKAGE THROUGH LAYER 19	0 0008	0 0021	0 0069	0 0080	0 0081	0 0124
	0 0138	0 0186	0 0162	0 0137	0 0106	0 0091

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ANNUAL TOTALS FOR YEAR 24

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	48496820 000	100 00
RUNOFF	0 027	98479 453	0 20
EVAPOTRANSPIRATION	13 187	47868200 000	98 70
PERC /LEAKAGE THROUGH LAYER 19	0 120291	436657 187	0 90
CHANGE IN WATER STORAGE	0 026	93386 539	0 19
SOIL WATER AT START OF YEAR	500 115	*************	
SOIL WATER AT END OF YEAR	500 140	*************	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	0 0000	98 121	0 00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 25

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 004	0 001	0 006	0 000	0 000	0 000
	0 000	0 000	0 000	0 016	0 000	0 000
EVAPOTRANSPIRATION	0 789	0 784	2 706	1 257	2 742	1 740

	0 450	0 049	0 160	1 579	0 704	0 229
PERCOLATION/LEAKAGE THROUGH LAYER 19	0 0095	0 0119	0 0101	0 0097	0 0086	0 0084
	0 0082	0 0056	0 0005	0 0000	0 0000	0 0048

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ANNUAL TOTALS FOR YEAR 25

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	48496820 000	100 00
RUNOFF	0 027	98480 594	0 20
EVAPOTRANSPIRATION	13 190	47880320 000	98 73
PERC /LEAKAGE THROUGH LAYER 19	0 077200	280235 156	0 58
CHANGE IN WATER STORAGE	0 066	237842 109	0 49
SOIL WATER AT START OF YEAR	500 140	*************	
SOIL WATER AT END OF YEAR	500 206	*************	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	0 0000	-59 933	0 00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 26

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 004	0 001	0 006	0 000	0 000	0 000
	0 000	0 000	0 000	0 016	0 000	0 000
EVAPOTRANSPIRATION	0 789	0 784	2 705	1 257	2 743	1 740

	0 451	0 049	0 160	1 578	0 703	0 229
PERCOLATION/LEAKAGE THROUGH	0 0073	0 0131	0 0167	0 0171	0 0145	0 0132
LAYER 19	0 0128	0 0087	0 0022	0 0000	0 0022	0 0090

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ANNUAL TOTALS FOR YEAR 26

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	48496820 000	100 00
RUNOFF	0 027	98314 992	0 20
EVAPOTRANSPIRATION	13 189	47875868 000	98 72
PERC /LEAKAGE THROUGH LAYER 19	0 116703	423633 625	0 87
CHANGE IN WATER STORAGE	0 027	99036 258	0 20
SOIL WATER AT START OF YEAR	500 206	*************	
SOIL WATER AT END OF YEAR	500 233	*************	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	0 0000	-35 051	0 00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 27

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 004	0 001	0 005	0 000	0 000	0 000
	0 000	0 000	0 000	0 016	0 000	0 000
EVAPOTRANSPIRATION	0 789	0 784	2 906	1 257	2 681	1 739

	0 450	0 049	0 160	1 580	0 704	0 229
PERCOLATION/LEAKAGE THROUGH LAYER 19	0 0097	0 0133	0 0169	0 0169	0 0156	0 0126
	0 0085	0 0073	0 0046	0 0023	0 0011	0 0025

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ANNUAL TOTALS FOR YEAR 27

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	48496820 000	100 00
RUNOFF	0 027	97271 336	0 20
EVAPOTRANSPIRATION	13 328	48380608 000	99 76
PERC /LEAKAGE THROUGH LAYER 19	0 111256	403859 531	0 83
CHANGE IN WATER STORAGE	-0 106	-384845 594	-0 79
SOIL WATER AT START OF YEAR	500 233	*************	
SOIL WATER AT END OF YEAR	500 127	*************	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	0 0000	-74 862	0 00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 28

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 004	0 001	0 006	0 000	0 000	0 000
	0 000	0 000	0 000	0 016	0 000	0 000
EVAPOTRANSPIRATION	0 789	0 796	2 735	1 230	2 727	1 740

	0 472	0 028	0 165	1 597	0 692	0 217
PERCOLATION/LEAKAGE THROUGH	0 0075	0 0146	0 0147	0 0122	0 0131	0 0125
LAYER 19	0 0125	0 0108	0 0103	0 0103	0 0078	0 0034

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ANNUAL TOTALS FOR YEAR 28

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	48496820 000	100 00
RUNOFF	0 027	98394 633	0 20
EVAPOTRANSPIRATION	13 189	47874440 000	98 72
PERC /LEAKAGE THROUGH LAYER 19	0 129735	470939 437	0 97
CHANGE IN WATER STORAGE	0 015	52952 270	0 11
SOIL WATER AT START OF YEAR	500 127	*************	
SOIL WATER AT END OF YEAR	500 142	*************	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	0 0000	93 253	0 00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 29

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 004	0 001	0 006	0 000	0 000	0 000
	0 000	0 000	0 000	0 016	0 000	0 000
EVAPOTRANSPIRATION	0 789	0 784	2 706	1 257	2 742	1 740

	0 451	0 049	0 161	1 578	0 703	0 229
PERCOLATION/LEAKAGE THROUGH LAYER 19	0 0000	0 0009	0 0014	0 0023	0 0039	0 0109
	0 0141	0 0187	0 0153	0 0127	0 0100	0 0108

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ANNUAL TOTALS FOR YEAR 29

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	48496820 000	100 00
RUNOFF	0 027	98198 789	0 20
EVAPOTRANSPIRATION	13 189	47877068 000	98 72
PERC /LEAKAGE THROUGH LAYER 19	0 101062	366854 812	0 76
CHANGE IN WATER STORAGE	0 043	154536 437	0 32
SOIL WATER AT START OF YEAR	500 142	*************	
SOIL WATER AT END OF YEAR	500 184	*************	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	0 0000	162 003	0 00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 30

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 004	0 001	0 005	0 000	0 000	0 000
	0 000	0 000	0 000	0 016	0 000	0 000
EVAPOTRANSPIRATION	0 789	0 784	2 905	1 257	2 682	1 740

	0 450	0 049	0 160	1 580	0 704	0 229
PERCOLATION/LEAKAGE THROUGH LAYER 19	0 0082	0 0073	0 0094	0 0113	0 0113	0 0088
	0 0078	0 0065	0 0037	0 0000	0 0000	0 0007

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ANNUAL TOTALS FOR YEAR 30

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	48496820 000	100 00
RUNOFF	0 027	97307 227	0 20
EVAPOTRANSPIRATION	13 330	48388500 000	99 78
PERC /LEAKAGE THROUGH LAYER 19	0 074946	272052 281	0 56
CHANGE IN WATER STORAGE	-0 072	-260884 094	-0 54
SOIL WATER AT START OF YEAR	500 184	*************	
SOIL WATER AT END OF YEAR	500 112	*************	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	0 0000	-154 512	0 00

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 30

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
STD DEVIATIONS	0 00	0 00	0 00	0 00	0 00	0 00
	0 00	0 00	0 00	0 00	0 00	0 00

RUNOFF

TOTALS	0 004	0 001	0 005	0 000	0 000	0 000
	0 000	0 000	0 000	0 016	0 000	0 000
STD DEVIATIONS	0 000	0 000	0 000	0 000	0 000	0 000
	0 000	0 000	0 000	0 000	0 000	0 000

EVAPOTRANSPIRATION

TOTALS	0 787	0 786	2 790	1 251	2 714	1 740
	0 455	0 044	0 161	1 584	0 701	0 227
STD DEVIATIONS	0 007	0 006	0 101	0 012	0 031	0 001
	0 009	0 009	0 002	0 008	0 005	0 005

PERCOLATION/LEAKAGE THROUGH LAYER 19

TOTALS	0 0039	0 0046	0 0059	0 0074	0 0085	0 0086
	0 0093	0 0089	0 0071	0 0063	0 0052	0 0045
STD DEVIATIONS	0 0039	0 0046	0 0048	0 0047	0 0046	0 0044
	0 0049	0 0051	0 0045	0 0045	0 0041	0 0037

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AVERAGE ANNUAL TOTALS & (STD DEVIATIONS) FOR YEARS 1 THROUGH 30

	INCHES		CU FEET	PERCENT
PRECIPITATION	13 36	(0 000)	48496828 0	100 00
RUNOFF	0 027	(0 0003)	98185 27	0 202
EVAPOTRANSPIRATION	13 240	(0 0682)	48059568 00	99 098
PERCOLATION/LEAKAGE THROUGH LAYER 19	0 08009	(0 03336)	290719 469	0 59946
CHANGE IN WATER STORAGE	0 013	(0 0684)	48329 10	0 100

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PEAK DAILY VALUES FOR YEARS 1 THROUGH 30

	(INCHES)	(CU FT)
PRECIPITATION	1 10	3993000 000
RUNOFF	0 016	59677 7617
PERCOLATION/LEAKAGE THROUGH LAYER 19	0 000845	3068 89160
SNOW WATER	0 79	2858422 7500
MAXIMUM VEG SOIL WATER (VOL/VOL)		0 3192
MINIMUM VEG SOIL WATER (VOL/VOL)		0 1360

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FINAL WATER STORAGE AT END OF YEAR 30

LAYER	(INCHES)	(VOL/VOL)
1	2 4723	0 2060
2	52 5599	0 2920
3	2 9280	0 2440
4	52 5600	0 2920
5	2 9280	0 2440
6	52 5600	0 2920
7	2 9280	0 2440
8	52 5600	0 2920
9	3 0317	0 2526
10	52 5600	0 2920
11	2 9467	0 2456
12	52 5600	0 2920
13	2 9566	0 2464
14	52 5600	0 2920
15	2 9964	0 2497
16	52 5600	0 2920
17	2 9859	0 2488
18	52 5600	0 2920
19	0 8989	0 0375
SNOW WATER	0 000	

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LEACHATE COLLECTION MODELING

CLOSED CELL CASE

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******************************************************************************
******************************************************************************
**                                                                          **
**                                                                          **
**             HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE                **
**               HELP MODEL VERSION 3 07  (1 NOVEMBER 1997)                 **
**                 DEVELOPED BY ENVIRONMENTAL LABORATORY                    **
**                   USAE WATERWAYS EXPERIMENT STATION                      **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY              **
**                                                                          **
**                                                                          **
******************************************************************************
******************************************************************************


PRECIPITATION DATA FILE      x \shire\help\proprecp D4
TEMPERATURE DATA FILE        x \shire\help\protemp D7
SOLAR RADIATION DATA FILE    x \shire\help\prosolar D13
EVAPOTRANSPIRATION DATA      x \shire\help\evapol2 D11
SOIL AND DESIGN DATA FILE    x \shire\help\cover D10
OUTPUT DATA FILE             x \shire\help\cover OUT


TIME   13 36     DATE    8/ 6/2003


******************************************************************************

     TITLE   Closed Cell Case

******************************************************************************


     NOTE   INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE
              COMPUTED AS NEARLY STEADY-STATE VALUES BY THE PROGRAM


                              LAYER  1
                              --------

                   TYPE 1 - VERTICAL PERCOLATION LAYER
                       MATERIAL TEXTURE NUMBER   0
          THICKNESS                  =      18 00   INCHES
          POROSITY                   =       0 5010 VOL/VOL
          FIELD CAPACITY             =       0 2840 VOL/VOL
          WILTING POINT              =       0 1350 VOL/VOL
          INITIAL SOIL WATER CONTENT =       0 2096 VOL/VOL
          EFFECTIVE SAT  HYD  COND   =  0 999999975000E-05 CM/SEC
```

LAYER 2

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 34

```
THICKNESS                    =      0 23    INCHES
POROSITY                     =      0 8500 VOL/VOL
FIELD CAPACITY               =      0 0100 VOL/VOL
WILTING POINT                =      0 0050 VOL/VOL
INITIAL SOIL WATER CONTENT   =      0 0100 VOL/VOL
EFFECTIVE SAT  HYD  COND     =   33 0000000000      CM/SEC
SLOPE                        =     33 00    PERCENT
DRAINAGE LENGTH              =   1250 0     FEET
```

LAYER 3

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 0

```
THICKNESS                    =      0 23    INCHES
POROSITY                     =      0 0000 VOL/VOL
FIELD CAPACITY               =      0 0000 VOL/VOL
WILTING POINT                =      0 0000 VOL/VOL
INITIAL SOIL WATER CONTENT   =      0 0000 VOL/VOL
EFFECTIVE SAT  HYD  COND     =  0 399999993000E-12 CM/SEC
FML PINHOLE DENSITY          =      1 00    HOLES/ACRE
FML INSTALLATION DEFECTS     =      3 00    HOLES/ACRE
FML PLACEMENT QUALITY        =  3 - GOOD
```

LAYER 4

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 17

```
THICKNESS                    =      0 23    INCHES
POROSITY                     =      0 7500 VOL/VOL
FIELD CAPACITY               =      0 7470 VOL/VOL
WILTING POINT                =      0 4000 VOL/VOL
INITIAL SOIL WATER CONTENT   =      0 7500 VOL/VOL
EFFECTIVE SAT  HYD  COND     =  0 300000003000E-08 CM/SEC
```

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED

SCS RUNOFF CURVE NUMBER	=	83 00	
FRACTION OF AREA ALLOWING RUNOFF	=	100 0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1000 000	ACRES
EVAPORATIVE ZONE DEPTH	=	12 0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	2 070	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	6 012	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1 620	INCHES
INITIAL SNOW WATER	=	0 000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	3 948	INCHES
TOTAL INITIAL WATER	=	3 948	INCHES
TOTAL SUBSURFACE INFLOW	=	0 00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
SALT LAKE CITY UTAH

STATION LATITUDE	=	40 76	DEGREES
MAXIMUM LEAF AREA INDEX	=	1 60	
START OF GROWING SEASON (JULIAN DATE)	=	117	
END OF GROWING SEASON (JULIAN DATE)	=	289	
EVAPORATIVE ZONE DEPTH	=	12 0	INCHES
AVERAGE ANNUAL WIND SPEED	=	8 80	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	67 00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	48 00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	39 00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	65 00	%

NOTE PRECIPITATION DATA FOR Bear River Refuge Utah
WAS ENTERED BY THE USER

NOTE TEMPERATURE DATA FOR Salt Lake City Utah
WAS ENTERED BY THE USER

NOTE SOLAR RADIATION DATA FOR Salt Lake City Utah
WAS ENTERED BY THE USER

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 068	0 000	0 569	0 000	0 051	0 000
	0 000	0 000	0 000	0 674	0 000	0 000
EVAPOTRANSPIRATION	0 658	0 732	2 477	1 172	2 306	1 740
	0 458	0 042	0 176	1 608	0 602	0 179
LATERAL DRAINAGE COLLECTED	0 0000	0 0029	0 0008	0 0000	0 0011	0 0000
FROM LAYER 2	0 0001	0 0000	0 0001	0 0001	0 0014	0 0000
PERCOLATION/LEAKAGE THROUGH	0 0000	0 0000	0 0000	0 0000	0 0000	0 0000
LAYER 4	0 0000	0 0000	0 0000	0 0000	0 0000	0 0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0 000	0 000	0 000	0 000	0 000	0 000
TOP OF LAYER 3	0 000	0 000	0 000	0 000	0 000	0 000
STD DEVIATION OF DAILY	0 000	0 000	0 000	0 000	0 000	0 000
HEAD ON TOP OF LAYER 3	0 000	0 000	0 000	0 000	0 000	0 000

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ANNUAL TOTALS FOR YEAR 1

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	48496820 000	100 00
RUNOFF	1 362	4943951 000	10 19
EVAPOTRANSPIRATION	12 151	44107872 000	90 95
DRAINAGE COLLECTED FROM LAYER 2	0 0064	23398 699	0 05
PERC /LEAKAGE THROUGH LAYER 4	0 000000	0 180	0 00
AVG HEAD ON TOP OF LAYER 3	0 0000		

CHANGE IN WATER STORAGE	-0 159	-578424 625	-1 19
SOIL WATER AT START OF YEAR	3 948	14332992 000	
SOIL WATER AT END OF YEAR	3 789	13754567 000	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	0 0000	23 916	0 00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 070	0 000	0 561	0 000	0 036	0 000
	0 000	0 000	0 000	0 682	0 000	0 001
EVAPOTRANSPIRATION	0 526	0 798	2 414	0 973	2 497	1 738
	0 458	0 042	0 187	1 108	0 637	0 132
LATERAL DRAINAGE COLLECTED	0 0000	0 0021	0 0006	0 0005	0 0028	0 0021
FROM LAYER 2	0 0000	0 0000	0 0001	0 0001	0 0024	0 0003
PERCOLATION/LEAKAGE THROUGH	0 0000	0 0000	0 0000	0 0000	0 0000	0 0000
LAYER 4	0 0000	0 0000	0 0000	0 0000	0 0000	0 0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0 000	0 000	0 000	0 000	0 000	0 000
TOP OF LAYER 3	0 000	0 000	0 000	0 000	0 000	0 000
STD DEVIATION OF DAILY	0 000	0 000	0 000	0 000	0 000	0 000
HEAD ON TOP OF LAYER 3	0 000	0 000	0 000	0 000	0 000	0 000

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ANNUAL TOTALS FOR YEAR 2

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	48496820 000	100 00
RUNOFF	1 349	4897264 500	10 10
EVAPOTRANSPIRATION	11 511	41783432 000	86 16
DRAINAGE COLLECTED FROM LAYER 2	0 0109	39690 785	0 08
PERC /LEAKAGE THROUGH LAYER 4	0 000000	0 215	0 00
AVG HEAD ON TOP OF LAYER 3	0 0000		
CHANGE IN WATER STORAGE	0 489	1776419 500	3 66
SOIL WATER AT START OF YEAR	3 789	13754567 000	
SOIL WATER AT END OF YEAR	4 279	15530986 000	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	0 0000	11 087	0 00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 3

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 087	0 000	0 550	0 000	0 030	0 000
	0 000	0 000	0 000	0 682	0 000	0 001
EVAPOTRANSPIRATION	0 473	1 232	2 396	1 146	2 443	1 739
	0 458	0 042	0 188	1 046	0 614	0 132
LATERAL DRAINAGE COLLECTED	0 0000	0 0009	0 0045	0 0000	0 0071	0 0013
FROM LAYER 2	0 0000	0 0000	0 0000	0 0005	0 0026	0 0001

PERCOLATION/LEAKAGE THROUGH	0 0000	0 0000	0 0000	0 0000	0 0000	0 0000
LAYER 4	0 0000	0 0000	0 0000	0 0000	0 0000	0 0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0 000	0 000	0 000	0 000	0 000	0 000
TOP OF LAYER 3	0 000	0 000	0 000	0 000	0 000	0 000
STD DEVIATION OF DAILY	0 000	0 000	0 000	0 000	0 000	0 000
HEAD ON TOP OF LAYER 3	0 000	0 000	0 000	0 000	0 000	0 000

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ANNUAL TOTALS FOR YEAR 3

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	48496820 000	100 00
RUNOFF	1 349	4897045 500	10 10
EVAPOTRANSPIRATION	11 910	43232728 000	89 15
DRAINAGE COLLECTED FROM LAYER 2	0 0172	62353 500	0 13
PERC /LEAKAGE THROUGH LAYER 4	0 000000	0 279	0 00
AVG HEAD ON TOP OF LAYER 3	0 0000		
CHANGE IN WATER STORAGE	0 084	304669 406	0 63
SOIL WATER AT START OF YEAR	4 279	15530986 000	
SOIL WATER AT END OF YEAR	4 362	15835656 000	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	0 0000	22 480	0 00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 4

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 095	0 000	0 550	0 000	0 030	0 000
	0 000	0 000	0 000	0 625	0 000	0 001
EVAPOTRANSPIRATION	0 459	1 261	2 571	1 170	2 315	1 739
	0 473	0 026	0 191	1 085	0 581	0 131
LATERAL DRAINAGE COLLECTED	0 0000	0 0003	0 0023	0 0001	0 0000	0 0011
FROM LAYER 2	0 0013	0 0001	0 0000	0 0000	0 0006	0 0000
PERCOLATION/LEAKAGE THROUGH	0 0000	0 0000	0 0000	0 0000	0 0000	0 0000
LAYER 4	0 0000	0 0000	0 0000	0 0000	0 0000	0 0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0 000	0 000	0 000	0 000	0 000	0 000
TOP OF LAYER 3	0 000	0 000	0 000	0 000	0 000	0 000
STD DEVIATION OF DAILY	0 000	0 000	0 000	0 000	0 000	0 000
HEAD ON TOP OF LAYER 3	0 000	0 000	0 000	0 000	0 000	0 000

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ANNUAL TOTALS FOR YEAR 4

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	48496820 000	100 00
RUNOFF	1 301	4724062 500	9 74
EVAPOTRANSPIRATION	12 002	43566804 000	89 83
DRAINAGE COLLECTED FROM LAYER 2	0 0057	20553 799	0 04
PERC /LEAKAGE THROUGH LAYER 4	0 000000	0 144	0 00
AVG HEAD ON TOP OF LAYER 3	0 0000		

CHANGE IN WATER STORAGE	0 051	185376 219	0 38
SOIL WATER AT START OF YEAR	4 362	15835656 000	
SOIL WATER AT END OF YEAR	4 414	16021032 000	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	0 0000	21 058	0 00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 5

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 101	0 000	0 554	0 000	0 029	0 000
	0 000	0 000	0 000	0 625	0 000	0 001
EVAPOTRANSPIRATION	0 456	1 186	2 548	1 220	2 406	1 739
	0 458	0 042	0 188	1 069	0 600	0 132
LATERAL DRAINAGE COLLECTED	0 0000	0 0008	0 0032	0 0008	0 0000	0 0007
FROM LAYER 2	0 0000	0 0001	0 0000	0 0007	0 0001	0 0000
PERCOLATION/LEAKAGE THROUGH	0 0000	0 0000	0 0000	0 0000	0 0000	0 0000
LAYER 4	0 0000	0 0000	0 0000	0 0000	0 0000	0 0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0 000	0 000	0 000	0 000	0 000	0 000
TOP OF LAYER 3	0 000	0 000	0 000	0 000	0 000	0 000
STD DEVIATION OF DAILY	0 000	0 000	0 000	0 000	0 000	0 000
HEAD ON TOP OF LAYER 3	0 000	0 000	0 000	0 000	0 000	0 000

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ANNUAL TOTALS FOR YEAR 5

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	48496820 000	100 00
RUNOFF	1 311	4757283 000	9 81
EVAPOTRANSPIRATION	12 044	43718024 000	90 15
DRAINAGE COLLECTED FROM LAYER 2	0 0064	23366 770	0 05
PERC /LEAKAGE THROUGH LAYER 4	0 000000	0 112	0 00
AVG HEAD ON TOP OF LAYER 3	0 0000		
CHANGE IN WATER STORAGE	-0 001	-1883 240	0 00
SOIL WATER AT START OF YEAR	4 414	16021032 000	
SOIL WATER AT END OF YEAR	4 413	16019149 000	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	0 0000	26 920	0 00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 6

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 101	0 000	0 554	0 000	0 029	0 000
	0 000	0 000	0 000	0 625	0 000	0 001
EVAPOTRANSPIRATION	0 456	1 185	2 549	1 220	2 406	1 740
	0 458	0 042	0 188	1 070	0 600	0 132
LATERAL DRAINAGE COLLECTED	0 0000	0 0012	0 0027	0 0008	0 0003	0 0002
FROM LAYER 2	0 0001	0 0001	0 0001	0 0000	0 0001	0 0003

PERCOLATION/LEAKAGE THROUGH	0 0000	0 0000	0 0000	0 0000	0 0000	0 0000
LAYER 4	0 0000	0 0000	0 0000	0 0000	0 0000	0 0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0 000	0 000	0 000	0 000	0 000	0 000
TOP OF LAYER 3	0 000	0 000	0 000	0 000	0 000	0 000
STD DEVIATION OF DAILY	0 000	0 000	0 000	0 000	0 000	0 000
HEAD ON TOP OF LAYER 3	0 000	0 000	0 000	0 000	0 000	0 000

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ANNUAL TOTALS FOR YEAR 6

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	48496820 000	100 00
RUNOFF	1 310	4756192 500	9 81
EVAPOTRANSPIRATION	12 044	43718336 000	90 15
DRAINAGE COLLECTED FROM LAYER 2	0 0060	21805 037	0 04
PERC /LEAKAGE THROUGH LAYER 4	0 000000	0 110	0 00
AVG HEAD ON TOP OF LAYER 3	0 0000		
CHANGE IN WATER STORAGE	0 000	453 501	0 00
SOIL WATER AT START OF YEAR	4 413	16019149 000	
SOIL WATER AT END OF YEAR	4 413	16019602 000	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	0 0000	30 827	0 00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 7

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 101	0 000	0 554	0 000	0 029	0 000
	0 000	0 000	0 000	0 625	0 000	0 001
EVAPOTRANSPIRATION	0 456	1 185	2 551	1 221	2 402	1 738
	0 458	0 042	0 187	1 070	0 600	0 132
LATERAL DRAINAGE COLLECTED	0 0000	0 0010	0 0006	0 0003	0 0033	0 0021
FROM LAYER 2	0 0000	0 0000	0 0001	0 0003	0 0001	0 0000
PERCOLATION/LEAKAGE THROUGH	0 0000	0 0000	0 0000	0 0000	0 0000	0 0000
LAYER 4	0 0000	0 0000	0 0000	0 0000	0 0000	0 0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0 000	0 000	0 000	0 000	0 000	0 000
TOP OF LAYER 3	0 000	0 000	0 000	0 000	0 000	0 000
STD DEVIATION OF DAILY	0 000	0 000	0 000	0 000	0 000	0 000
HEAD ON TOP OF LAYER 3	0 000	0 000	0 000	0 000	0 000	0 000

ANNUAL TOTALS FOR YEAR 7

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	48496820 000	100 00
RUNOFF	1 311	4757306 500	9 81
EVAPOTRANSPIRATION	12 042	43711396 000	90 13
DRAINAGE COLLECTED FROM LAYER 2	0 0079	28533 217	0 06
PERC /LEAKAGE THROUGH LAYER 4	0 000000	0 126	0 00
AVG HEAD ON TOP OF LAYER 3	0 0000		

CHANGE IN WATER STORAGE	0 000	-451 770	0 00
SOIL WATER AT START OF YEAR	4 413	16019602 000	
SOIL WATER AT END OF YEAR	4 413	16019151 000	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	0 0000	35 040	0 00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 8

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 101	0 000	0 554	0 000	0 029	0 000
	0 000	0 000	0 000	0 625	0 000	0 001
EVAPOTRANSPIRATION	0 456	1 225	2 610	1 133	2 389	1 740
	0 474	0 026	0 191	1 085	0 582	0 131
LATERAL DRAINAGE COLLECTED	0 0000	0 0012	0 0020	0 0008	0 0031	0 0003
FROM LAYER 2	0 0000	0 0001	0 0001	0 0001	0 0000	0 0000
PERCOLATION/LEAKAGE THROUGH	0 0000	0 0000	0 0000	0 0000	0 0000	0 0000
LAYER 4	0 0000	0 0000	0 0000	0 0000	0 0000	0 0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0 000	0 000	0 000	0 000	0 000	0 000
TOP OF LAYER 3	0 000	0 000	0 000	0 000	0 000	0 000
STD DEVIATION OF DAILY	0 000	0 000	0 000	0 000	0 000	0 000
HEAD ON TOP OF LAYER 3	0 000	0 000	0 000	0 000	0 000	0 000

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ANNUAL TOTALS FOR YEAR 8

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	48496820 000	100 00
RUNOFF	1 310	4756466 000	9 81
EVAPOTRANSPIRATION	12 041	43709968 000	90 13
DRAINAGE COLLECTED FROM LAYER 2	0 0079	28568 770	0 06
PERC /LEAKAGE THROUGH LAYER 4	0 000000	0 126	0 00
AVG HEAD ON TOP OF LAYER 3	0 0000		
CHANGE IN WATER STORAGE	0 000	1791 501	0 00
SOIL WATER AT START OF YEAR	4 413	16019151 000	
SOIL WATER AT END OF YEAR	4 413	16020942 000	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	0 0000	26 318	0 00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 9

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 101	0 000	0 554	0 000	0 029	0 000
	0 000	0 000	0 000	0 625	0 000	0 001
EVAPOTRANSPIRATION	0 456	1 186	2 550	1 220	2 406	1 740
	0 458	0 042	0 188	1 070	0 599	0 132
LATERAL DRAINAGE COLLECTED	0 0000	0 0009	0 0019	0 0003	0 0002	0 0004
FROM LAYER 2	0 0000	0 0000	0 0000	0 0000	0 0013	0 0001

PERCOLATION/LEAKAGE THROUGH	0 0000	0 0000	0 0000	0 0000	0 0000	0 0000
LAYER 4	0 0000	0 0000	0 0000	0 0000	0 0000	0 0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0 000	0 000	0 000	0 000	0 000	0 000
TOP OF LAYER 3	0 000	0 000	0 000	0 000	0 000	0 000
STD DEVIATION OF DAILY	0 000	0 000	0 000	0 000	0 000	0 000
HEAD ON TOP OF LAYER 3	0 000	0 000	0 000	0 000	0 000	0 000

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ANNUAL TOTALS FOR YEAR 9

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	48496820 000	100 00
RUNOFF	1 310	4756205 500	9 81
EVAPOTRANSPIRATION	12 045	43724816 000	90 16
DRAINAGE COLLECTED FROM LAYER 2	0 0052	18842 871	0 04
PERC /LEAKAGE THROUGH LAYER 4	0 000000	0 118	0 00
AVG HEAD ON TOP OF LAYER 3	0 0000		
CHANGE IN WATER STORAGE	-0 001	-3058 534	-0 01
SOIL WATER AT START OF YEAR	4 413	16020942 000	
SOIL WATER AT END OF YEAR	4 413	16017884 000	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	0 0000	14 939	0 00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 10

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 101	0 000	0 554	0 000	0 029	0 000
	0 000	0 000	0 000	0 625	0 000	0 001
EVAPOTRANSPIRATION	0 455	1 186	2 550	1 220	2 403	1 739
	0 458	0 042	0 187	1 069	0 600	0 132
LATERAL DRAINAGE COLLECTED	0 0001	0 0008	0 0011	0 0009	0 0026	0 0007
FROM LAYER 2	0 0005	0 0000	0 0002	0 0005	0 0000	0 0000
PERCOLATION/LEAKAGE THROUGH	0 0000	0 0000	0 0000	0 0000	0 0000	0 0000
LAYER 4	0 0000	0 0000	0 0000	0 0000	0 0000	0 0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0 000	0 000	0 000	0 000	0 000	0 000
TOP OF LAYER 3	0 000	0 000	0 000	0 000	0 000	0 000
STD DEVIATION OF DAILY	0 000	0 000	0 000	0 000	0 000	0 000
HEAD ON TOP OF LAYER 3	0 000	0 000	0 000	0 000	0 000	0 000

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ANNUAL TOTALS FOR YEAR 10

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	48496820 000	100 00
RUNOFF	1 311	4757280 500	9 81
EVAPOTRANSPIRATION	12 042	43711488 000	90 13
DRAINAGE COLLECTED FROM LAYER 2	0 0074	26758 070	0 06
PERC /LEAKAGE THROUGH LAYER 4	0 000000	0 123	0 00
AVG HEAD ON TOP OF LAYER 3	0 0000		

CHANGE IN WATER STORAGE	0 000	1263 571	0 00
SOIL WATER AT START OF YEAR	4 413	16017884 000	
SOIL WATER AT END OF YEAR	4 413	16019147 000	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	0 0000	30 805	0 00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 11

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 101	0 000	0 554	0 000	0 029	0 000
	0 000	0 000	0 000	0 625	0 000	0 001
EVAPOTRANSPIRATION	0 456	1 185	2 549	1 220	2 404	1 740
	0 458	0 042	0 187	1 070	0 600	0 132
LATERAL DRAINAGE COLLECTED	0 0000	0 0009	0 0029	0 0003	0 0024	0 0000
FROM LAYER 2	0 0002	0 0000	0 0001	0 0000	0 0000	0 0000
PERCOLATION/LEAKAGE THROUGH	0 0000	0 0000	0 0000	0 0000	0 0000	0 0000
LAYER 4	0 0000	0 0000	0 0000	0 0000	0 0000	0 0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0 000	0 000	0 000	0 000	0 000	0 000
TOP OF LAYER 3	0 000	0 000	0 000	0 000	0 000	0 000
STD DEVIATION OF DAILY	0 000	0 000	0 000	0 000	0 000	0 000
HEAD ON TOP OF LAYER 3	0 000	0 000	0 000	0 000	0 000	0 000

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ANNUAL TOTALS FOR YEAR 11

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	48496820 000	100 00
RUNOFF	1 310	4756445 000	9 81
EVAPOTRANSPIRATION	12 042	43713196 000	90 14
DRAINAGE COLLECTED FROM LAYER 2	0 0070	25364 633	0 05
PERC /LEAKAGE THROUGH LAYER 4	0 000000	0 119	0 00
AVG HEAD ON TOP OF LAYER 3	0 0000		
CHANGE IN WATER STORAGE	0 000	1791 501	0 00
SOIL WATER AT START OF YEAR	4 413	16019147 000	
SOIL WATER AT END OF YEAR	4 413	16020939 000	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	0 0000	21 336	0 00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 12

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 101	0 000	0 554	0 000	0 029	0 000
	0 000	0 000	0 000	0 625	0 000	0 001
EVAPOTRANSPIRATION	0 456	1 225	2 611	1 133	2 390	1 739
	0 474	0 026	0 191	1 085	0 582	0 131
LATERAL DRAINAGE COLLECTED	0 0000	0 0010	0 0016	0 0008	0 0026	0 0007
FROM LAYER 2	0 0001	0 0000	0 0000	0 0003	0 0000	0 0003

PERCOLATION/LEAKAGE THROUGH	0 0000	0 0000	0 0000	0 0000	0 0000	0 0000
LAYER 4	0 0000	0 0000	0 0000	0 0000	0 0000	0 0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0 000	0 000	0 000	0 000	0 000	0 000
TOP OF LAYER 3	0 000	0 000	0 000	0 000	0 000	0 000
STD DEVIATION OF DAILY	0 000	0 000	0 000	0 000	0 000	0 000
HEAD ON TOP OF LAYER 3	0 000	0 000	0 000	0 000	0 000	0 000

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ANNUAL TOTALS FOR YEAR 12

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	48496820 000	100 00
RUNOFF	1 311	4757274 500	9 81
EVAPOTRANSPIRATION	12 043	43715592 000	90 14
DRAINAGE COLLECTED FROM LAYER 2	0 0074	26869 625	0 06
PERC /LEAKAGE THROUGH LAYER 4	0 000000	0 129	0 00
AVG HEAD ON TOP OF LAYER 3	0 0000		
CHANGE IN WATER STORAGE	-0 001	-2952 948	-0 01
SOIL WATER AT START OF YEAR	4 413	16020939 000	
SOIL WATER AT END OF YEAR	4 413	16017986 000	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	0 0000	36 082	0 00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 13

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 101	0 000	0 554	0 000	0 030	0 000
	0 000	0 000	0 000	0 625	0 000	0 001
EVAPOTRANSPIRATION	0 455	1 185	2 549	1 220	2 400	1 740
	0 458	0 042	0 187	1 069	0 600	0 132
LATERAL DRAINAGE COLLECTED	0 0000	0 0010	0 0023	0 0003	0 0059	0 0001
FROM LAYER 2	0 0000	0 0001	0 0001	0 0011	0 0004	0 0004
PERCOLATION/LEAKAGE THROUGH	0 0000	0 0000	0 0000	0 0000	0 0000	0 0000
LAYER 4	0 0000	0 0000	0 0000	0 0000	0 0000	0 0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0 000	0 000	0 000	0 000	0 000	0 000
TOP OF LAYER 3	0 000	0 000	0 000	0 000	0 000	0 000
STD DEVIATION OF DAILY	0 000	0 000	0 000	0 000	0 000	0 000
HEAD ON TOP OF LAYER 3	0 000	0 000	0 000	0 000	0 000	0 000

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ANNUAL TOTALS FOR YEAR 13

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	48496820 000	100 00
RUNOFF	1 311	4757982 500	9 81
EVAPOTRANSPIRATION	12 038	43696240 000	90 10
DRAINAGE COLLECTED FROM LAYER 2	0 0117	42626 664	0 09
PERC /LEAKAGE THROUGH LAYER 4	0 000000	0 177	0 00
AVG HEAD ON TOP OF LAYER 3	0 0000		

CHANGE IN WATER STORAGE	0 000	-64 044	0 00
SOIL WATER AT START OF YEAR	4 413	16017986 000	
SOIL WATER AT END OF YEAR	4 413	16017922 000	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	0 0000	33 387	0 00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 14

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 101	0 000	0 554	0 000	0 029	0 000
	0 000	0 000	0 000	0 625	0 000	0 001
EVAPOTRANSPIRATION	0 455	1 186	2 551	1 219	2 403	1 740
	0 458	0 042	0 187	1 070	0 600	0 132
LATERAL DRAINAGE COLLECTED	0 0000	0 0008	0 0001	0 0015	0 0032	0 0001
FROM LAYER 2	0 0003	0 0000	0 0001	0 0002	0 0003	0 0003
PERCOLATION/LEAKAGE THROUGH	0 0000	0 0000	0 0000	0 0000	0 0000	0 0000
LAYER 4	0 0000	0 0000	0 0000	0 0000	0 0000	0 0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0 000	0 000	0 000	0 000	0 000	0 000
TOP OF LAYER 3	0 000	0 000	0 000	0 000	0 000	0 000
STD DEVIATION OF DAILY	0 000	0 000	0 000	0 000	0 000	0 000
HEAD ON TOP OF LAYER 3	0 000	0 000	0 000	0 000	0 000	0 000

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ANNUAL TOTALS FOR YEAR 14

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	48496820 000	100 00
RUNOFF	1 311	4757291 000	9 81
EVAPOTRANSPIRATION	12 043	43714708 000	90 14
DRAINAGE COLLECTED FROM LAYER 2	0 0068	24842 320	0 05
PERC /LEAKAGE THROUGH LAYER 4	0 000000	0 133	0 00
AVG HEAD ON TOP OF LAYER 3	0 0000		
CHANGE IN WATER STORAGE	0 000	-31 157	0 00
SOIL WATER AT START OF YEAR	4 413	16017922 000	
SOIL WATER AT END OF YEAR	4 413	16017890 000	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	0 0000	11 378	0 00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 15

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 101	0 000	0 554	0 000	0 029	0 000
	0 000	0 000	0 000	0 625	0 000	0 001
EVAPOTRANSPIRATION	0 455	1 185	2 549	1 220	2 406	1 736
	0 458	0 042	0 187	1 070	0 599	0 132
LATERAL DRAINAGE COLLECTED	0 0000	0 0012	0 0021	0 0008	0 0007	0 0036
FROM LAYER 2	0 0000	0 0000	0 0002	0 0000	0 0006	0 0000

PERCOLATION/LEAKAGE THROUGH	0 0000	0 0000	0 0000	0 0000	0 0000	0 0000
LAYER 4	0 0000	0 0000	0 0000	0 0000	0 0000	0 0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0 000	0 000	0 000	0 000	0 000	0 000
TOP OF LAYER 3	0 000	0 000	0 000	0 000	0 000	0 000
STD DEVIATION OF DAILY	0 000	0 000	0 000	0 000	0 000	0 000
HEAD ON TOP OF LAYER 3	0 000	0 000	0 000	0 000	0 000	0 000

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ANNUAL TOTALS FOR YEAR 15

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	48496820 000	100 00
RUNOFF	1 310	4756185 500	9 81
EVAPOTRANSPIRATION	12 040	43704576 000	90 12
DRAINAGE COLLECTED FROM LAYER 2	0 0092	33334 941	0 07
PERC /LEAKAGE THROUGH LAYER 4	0 000000	0 146	0 00
AVG HEAD ON TOP OF LAYER 3	0 0000		
CHANGE IN WATER STORAGE	0 001	2712 350	0 01
SOIL WATER AT START OF YEAR	4 413	16017890 000	
SOIL WATER AT END OF YEAR	4 413	16020603 000	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	0 0000	9 766	0 00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 16

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 101	0 000	0 554	0 000	0 029	0 000
	0 000	0 000	0 000	0 625	0 000	0 001
EVAPOTRANSPIRATION	0 456	1 225	2 610	1 133	2 392	1 740
	0 474	0 026	0 191	1 085	0 582	0 131
LATERAL DRAINAGE COLLECTED	0 0000	0 0009	0 0020	0 0004	0 0005	0 0004
FROM LAYER 2	0 0000	0 0001	0 0001	0 0002	0 0006	0 0003
PERCOLATION/LEAKAGE THROUGH	0 0000	0 0000	0 0000	0 0000	0 0000	0 0000
LAYER 4	0 0000	0 0000	0 0000	0 0000	0 0000	0 0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0 000	0 000	0 000	0 000	0 000	0 000
TOP OF LAYER 3	0 000	0 000	0 000	0 000	0 000	0 000
STD DEVIATION OF DAILY	0 000	0 000	0 000	0 000	0 000	0 000
HEAD ON TOP OF LAYER 3	0 000	0 000	0 000	0 000	0 000	0 000

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ANNUAL TOTALS FOR YEAR 16

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	48496820 000	100 00
RUNOFF	1 310	4756258 000	9 81
EVAPOTRANSPIRATION	12 045	43721580 000	90 15
DRAINAGE COLLECTED FROM LAYER 2	0 0055	20125 250	0 04
PERC /LEAKAGE THROUGH LAYER 4	0 000000	0 094	0 00
AVG HEAD ON TOP OF LAYER 3	0 0000		

CHANGE IN WATER STORAGE	0 000	-1164 908	0 00
SOIL WATER AT START OF YEAR	4 413	16020603 000	
SOIL WATER AT END OF YEAR	4 413	16019438 000	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	0 0000	19 956	0 00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 17

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 101	0 000	0 554	0 000	0 030	0 000
	0 000	0 000	0 000	0 625	0 000	0 001
EVAPOTRANSPIRATION	0 456	1 186	2 549	1 220	2 399	1 740
	0 458	0 042	0 188	1 070	0 599	0 132
LATERAL DRAINAGE COLLECTED	0 0000	0 0009	0 0019	0 0003	0 0070	0 0005
FROM LAYER 2	0 0001	0 0000	0 0000	0 0000	0 0006	0 0003
PERCOLATION/LEAKAGE THROUGH	0 0000	0 0000	0 0000	0 0000	0 0000	0 0000
LAYER 4	0 0000	0 0000	0 0000	0 0000	0 0000	0 0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0 000	0 000	0 000	0 000	0 000	0 000
TOP OF LAYER 3	0 000	0 000	0 000	0 000	0 000	0 000
STD DEVIATION OF DAILY	0 000	0 000	0 000	0 000	0 000	0 000
HEAD ON TOP OF LAYER 3	0 000	0 000	0 000	0 000	0 000	0 000

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ANNUAL TOTALS FOR YEAR 17

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	48496820 000	100 00
RUNOFF	1 311	4757936 500	9 81
EVAPOTRANSPIRATION	12 038	43696524 000	90 10
DRAINAGE COLLECTED FROM LAYER 2	0 0116	42134 465	0 09
PERC /LEAKAGE THROUGH LAYER 4	0 000000	0 164	0 00
AVG HEAD ON TOP OF LAYER 3	0 0000		
CHANGE IN WATER STORAGE	0 000	199 056	0 00
SOIL WATER AT START OF YEAR	4 413	16019438 000	
SOIL WATER AT END OF YEAR	4 413	16019637 000	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	0 0000	24 931	0 00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 18

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 101	0 000	0 554	0 000	0 029	0 000
	0 000	0 000	0 000	0 625	0 000	0 001
EVAPOTRANSPIRATION	0 456	1 186	2 548	1 220	2 406	1 739
	0 458	0 042	0 188	1 070	0 600	0 132
LATERAL DRAINAGE COLLECTED	0 0000	0 0008	0 0031	0 0003	0 0002	0 0005
FROM LAYER 2	0 0003	0 0001	0 0000	0 0000	0 0001	0 0000

PERCOLATION/LEAKAGE THROUGH	0 0000	0 0000	0 0000	0 0000	0 0000	0 0000
LAYER 4	0 0000	0 0000	0 0000	0 0000	0 0000	0 0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0 000	0 000	0 000	0 000	0 000	0 000
TOP OF LAYER 3	0 000	0 000	0 000	0 000	0 000	0 000
STD DEVIATION OF DAILY	0 000	0 000	0 000	0 000	0 000	0 000
HEAD ON TOP OF LAYER 3	0 000	0 000	0 000	0 000	0 000	0 000

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ANNUAL TOTALS FOR YEAR 18

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	48496820 000	100 00
RUNOFF	1 310	4756191 000	9 81
EVAPOTRANSPIRATION	12 044	43721048 000	90 15
DRAINAGE COLLECTED FROM LAYER 2	0 0055	20066 984	0 04
PERC /LEAKAGE THROUGH LAYER 4	0 000000	0 091	0 00
AVG HEAD ON TOP OF LAYER 3	0 0000		
CHANGE IN WATER STORAGE	0 000	-510 621	0 00
SOIL WATER AT START OF YEAR	4 413	16019637 000	
SOIL WATER AT END OF YEAR	4 413	16019126 000	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	0 0000	24 134	0 00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 19

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 101	0 000	0 554	0 000	0 029	0 000
	0 000	0 000	0 000	0 625	0 000	0 001
EVAPOTRANSPIRATION	0 455	1 186	2 547	1 220	2 404	1 739
	0 458	0 042	0 188	1 070	0 600	0 132
LATERAL DRAINAGE COLLECTED	0 0001	0 0009	0 0046	0 0006	0 0014	0 0013
FROM LAYER 2	0 0000	0 0001	0 0000	0 0000	0 0000	0 0000
PERCOLATION/LEAKAGE THROUGH	0 0000	0 0000	0 0000	0 0000	0 0000	0 0000
LAYER 4	0 0000	0 0000	0 0000	0 0000	0 0000	0 0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0 000	0 000	0 000	0 000	0 000	0 000
TOP OF LAYER 3	0 000	0 000	0 000	0 000	0 000	0 000
STD DEVIATION OF DAILY	0 000	0 000	0 000	0 000	0 000	0 000
HEAD ON TOP OF LAYER 3	0 000	0 000	0 000	0 000	0 000	0 000

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ANNUAL TOTALS FOR YEAR 19

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	48496820 000	100 00
RUNOFF	1 311	4757282 500	9 81
EVAPOTRANSPIRATION	12 040	43705496 000	90 12
DRAINAGE COLLECTED FROM LAYER 2	0 0090	32522 857	0 07
PERC /LEAKAGE THROUGH LAYER 4	0 000000	0 136	0 00
AVG HEAD ON TOP OF LAYER 3	0 0000		

CHANGE IN WATER STORAGE	0 000	1495 514	0 00
SOIL WATER AT START OF YEAR	4 413	16019126 000	
SOIL WATER AT END OF YEAR	4 413	16020622 000	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	0 0000	24 341	0 00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 20

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 101	0 000	0 554	0 000	0 029	0 000
	0 000	0 000	0 000	0 625	0 000	0 001
EVAPOTRANSPIRATION	0 456	1 226	2 610	1 133	2 390	1 740
	0 474	0 026	0 191	1 085	0 582	0 131
LATERAL DRAINAGE COLLECTED	0 0000	0 0008	0 0023	0 0003	0 0024	0 0003
FROM LAYER 2	0 0000	0 0001	0 0000	0 0004	0 0001	0 0000
PERCOLATION/LEAKAGE THROUGH	0 0000	0 0000	0 0000	0 0000	0 0000	0 0000
LAYER 4	0 0000	0 0000	0 0000	0 0000	0 0000	0 0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0 000	0 000	0 000	0 000	0 000	0 000
TOP OF LAYER 3	0 000	0 000	0 000	0 000	0 000	0 000
STD DEVIATION OF DAILY	0 000	0 000	0 000	0 000	0 000	0 000
HEAD ON TOP OF LAYER 3	0 000	0 000	0 000	0 000	0 000	0 000

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ANNUAL TOTALS FOR YEAR 20

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	48496820 000	100 00
RUNOFF	1 310	4756409 000	9 81
EVAPOTRANSPIRATION	12 043	43717576 000	90 15
DRAINAGE COLLECTED FROM LAYER 2	0 0067	24298 156	0 05
PERC /LEAKAGE THROUGH LAYER 4	0 000000	0 119	0 00
AVG HEAD ON TOP OF LAYER 3	0 0000		
CHANGE IN WATER STORAGE	0 000	-1492 052	0 00
SOIL WATER AT START OF YEAR	4 413	16020622 000	
SOIL WATER AT END OF YEAR	4 413	16019130 000	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	0 0000	28 492	0 00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 21

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 101	0 000	0 554	0 000	0 029	0 000
	0 000	0 000	0 000	0 625	0 000	0 001
EVAPOTRANSPIRATION	0 455	1 186	2 551	1 220	2 406	1 740
	0 457	0 042	0 188	1 070	0 599	0 132
LATERAL DRAINAGE COLLECTED	0 0003	0 0009	0 0008	0 0003	0 0004	0 0002
FROM LAYER 2	0 0014	0 0000	0 0000	0 0002	0 0006	0 0000

PERCOLATION/LEAKAGE THROUGH	0 0000	0 0000	0 0000	0 0000	0 0000	0 0000
LAYER 4	0 0000	0 0000	0 0000	0 0000	0 0000	0 0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0 000	0 000	0 000	0 000	0 000	0 000
TOP OF LAYER 3	0 000	0 000	0 000	0 000	0 000	0 000
STD DEVIATION OF DAILY	0 000	0 000	0 000	0 000	0 000	0 000
HEAD ON TOP OF LAYER 3	0 000	0 000	0 000	0 000	0 000	0 000

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ANNUAL TOTALS FOR YEAR 21

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	48496820 000	100 00
RUNOFF	1 310	4756189 000	9 81
EVAPOTRANSPIRATION	12 044	43720904 000	90 15
DRAINAGE COLLECTED FROM LAYER 2	0 0050	18242 756	0 04
PERC /LEAKAGE THROUGH LAYER 4	0 000000	0 108	0 00
AVG HEAD ON TOP OF LAYER 3	0 0000		
CHANGE IN WATER STORAGE	0 000	1471 281	0 00
SOIL WATER AT START OF YEAR	4 413	16019130 000	
SOIL WATER AT END OF YEAR	4 413	16020601 000	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	0 0000	13 570	0 00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 22

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 101	0 000	0 554	0 000	0 029	0 000
	0 000	0 000	0 000	0 625	0 000	0 001
EVAPOTRANSPIRATION	0 456	1 186	2 547	1 220	2 406	1 740
	0 458	0 042	0 188	1 070	0 600	0 132
LATERAL DRAINAGE COLLECTED	0 0000	0 0009	0 0043	0 0008	0 0000	0 0001
FROM LAYER 2	0 0000	0 0001	0 0000	0 0000	0 0000	0 0000
PERCOLATION/LEAKAGE THROUGH	0 0000	0 0000	0 0000	0 0000	0 0000	0 0000
LAYER 4	0 0000	0 0000	0 0000	0 0000	0 0000	0 0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0 000	0 000	0 000	0 000	0 000	0 000
TOP OF LAYER 3	0 000	0 000	0 000	0 000	0 000	0 000
STD DEVIATION OF DAILY	0 000	0 000	0 000	0 000	0 000	0 000
HEAD ON TOP OF LAYER 3	0 000	0 000	0 000	0 000	0 000	0 000

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ANNUAL TOTALS FOR YEAR 22

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	48496820 000	100 00
RUNOFF	1 311	4757280 500	9 81
EVAPOTRANSPIRATION	12 043	43716432 000	90 14
DRAINAGE COLLECTED FROM LAYER 2	0 0064	23082 977	0 05
PERC /LEAKAGE THROUGH LAYER 4	0 000000	0 120	0 00
AVG HEAD ON TOP OF LAYER 3	0 0000		

CHANGE IN WATER STORAGE	0 000	17 309	0 00
SOIL WATER AT START OF YEAR	4 413	16020601 000	
SOIL WATER AT END OF YEAR	4 413	16020618 000	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	0 0000	5 198	0 00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 23

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 101	0 000	0 554	0 000	0 029	0 000
	0 000	0 000	0 000	0 625	0 000	0 001
EVAPOTRANSPIRATION	0 456	1 185	2 550	1 220	2 405	1 737
	0 457	0 042	0 188	1 070	0 600	0 132
LATERAL DRAINAGE COLLECTED	0 0000	0 0013	0 0013	0 0008	0 0019	0 0028
FROM LAYER 2	0 0007	0 0001	0 0000	0 0005	0 0004	0 0000
PERCOLATION/LEAKAGE THROUGH	0 0000	0 0000	0 0000	0 0000	0 0000	0 0000
LAYER 4	0 0000	0 0000	0 0000	0 0000	0 0000	0 0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0 000	0 000	0 000	0 000	0 000	0 000
TOP OF LAYER 3	0 000	0 000	0 000	0 000	0 000	0 000
STD DEVIATION OF DAILY	0 000	0 000	0 000	0 000	0 000	0 000
HEAD ON TOP OF LAYER 3	0 000	0 000	0 000	0 000	0 000	0 000

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ANNUAL TOTALS FOR YEAR 23

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	48496820 000	100 00
RUNOFF	1 310	4756250 500	9 81
EVAPOTRANSPIRATION	12 041	43707256 000	90 12
DRAINAGE COLLECTED FROM LAYER 2	0 0097	35259 078	0 07
PERC /LEAKAGE THROUGH LAYER 4	0 000000	0 137	0 00
AVG HEAD ON TOP OF LAYER 3	0 0000		
CHANGE IN WATER STORAGE	-0 001	-1968 055	0 00
SOIL WATER AT START OF YEAR	4 413	16020618 000	
SOIL WATER AT END OF YEAR	4 413	16018650 000	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	0 0000	21 672	0 00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 24

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 101	0 000	0 554	0 000	0 029	0 000
	0 000	0 000	0 000	0 625	0 000	0 001
EVAPOTRANSPIRATION	0 455	1 226	2 611	1 133	2 392	1 739
	0 474	0 026	0 191	1 085	0 582	0 131
LATERAL DRAINAGE COLLECTED	0 0001	0 0008	0 0016	0 0008	0 0006	0 0012
FROM LAYER 2	0 0000	0 0000	0 0000	0 0000	0 0003	0 0000

PERCOLATION/LEAKAGE THROUGH	0 0000	0 0000	0 0000	0 0000	0 0000	0 0000
LAYER 4	0 0000	0 0000	0 0000	0 0000	0 0000	0 0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0 000	0 000	0 000	0 000	0 000	0 000
TOP OF LAYER 3	0 000	0 000	0 000	0 000	0 000	0 000
STD DEVIATION OF DAILY	0 000	0 000	0 000	0 000	0 000	0 000
HEAD ON TOP OF LAYER 3	0 000	0 000	0 000	0 000	0 000	0 000

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ANNUAL TOTALS FOR YEAR 24

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	48496820 000	100 00
RUNOFF	1 310	4756186 000	9 81
EVAPOTRANSPIRATION	12 044	43719648 000	90 15
DRAINAGE COLLECTED FROM LAYER 2	0 0055	20005 838	0 04
PERC /LEAKAGE THROUGH LAYER 4	0 000000	0 108	0 00
AVG HEAD ON TOP OF LAYER 3	0 0000		
CHANGE IN WATER STORAGE	0 000	957 198	0 00
SOIL WATER AT START OF YEAR	4 413	16018650 000	
SOIL WATER AT END OF YEAR	4 413	16019608 000	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	0 0000	20 787	0 00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 25

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 101	0 000	0 554	0 000	0 029	0 000
	0 000	0 000	0 000	0 625	0 000	0 001
EVAPOTRANSPIRATION	0 456	1 186	2 545	1 220	2 406	1 739
	0 458	0 042	0 188	1 070	0 600	0 132
LATERAL DRAINAGE COLLECTED	0 0000	0 0009	0 0033	0 0039	0 0000	0 0012
FROM LAYER 2	0 0000	0 0003	0 0000	0 0000	0 0000	0 0004
PERCOLATION/LEAKAGE THROUGH	0 0000	0 0000	0 0000	0 0000	0 0000	0 0000
LAYER 4	0 0000	0 0000	0 0000	0 0000	0 0000	0 0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0 000	0 000	0 000	0 000	0 000	0 000
TOP OF LAYER 3	0 000	0 000	0 000	0 000	0 000	0 000
STD DEVIATION OF DAILY	0 000	0 000	0 000	0 000	0 000	0 000
HEAD ON TOP OF LAYER 3	0 000	0 000	0 000	0 000	0 000	0 000

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ANNUAL TOTALS FOR YEAR 25

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	48496820 000	100 00
RUNOFF	1 311	4757300 500	9 81
EVAPOTRANSPIRATION	12 039	43702812 000	90 11
DRAINAGE COLLECTED FROM LAYER 2	0 0101	36677 852	0 08
PERC /LEAKAGE THROUGH LAYER 4	0 000000	0 144	0 00
AVG HEAD ON TOP OF LAYER 3	0 0000		

CHANGE IN WATER STORAGE	0 000	20 771	0 00
SOIL WATER AT START OF YEAR	4 413	16019608 000	
SOIL WATER AT END OF YEAR	4 413	16019628 000	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	0 0000	8 831	0 00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 26

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 101	0 000	0 554	0 000	0 030	0 000
	0 000	0 000	0 000	0 625	0 000	0 001
EVAPOTRANSPIRATION	0 456	1 185	2 548	1 220	2 402	1 739
	0 458	0 042	0 187	1 070	0 600	0 132
LATERAL DRAINAGE COLLECTED	0 0000	0 0012	0 0031	0 0006	0 0038	0 0012
FROM LAYER 2	0 0001	0 0001	0 0001	0 0001	0 0002	0 0000
PERCOLATION/LEAKAGE THROUGH	0 0000	0 0000	0 0000	0 0000	0 0000	0 0000
LAYER 4	0 0000	0 0000	0 0000	0 0000	0 0000	0 0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0 000	0 000	0 000	0 000	0 000	0 000
TOP OF LAYER 3	0 000	0 000	0 000	0 000	0 000	0 000
STD DEVIATION OF DAILY	0 000	0 000	0 000	0 000	0 000	0 000
HEAD ON TOP OF LAYER 3	0 000	0 000	0 000	0 000	0 000	0 000

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ANNUAL TOTALS FOR YEAR 26

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	48496820 000	100 00
RUNOFF	1 311	4757484 500	9 81
EVAPOTRANSPIRATION	12 039	43702124 000	90 11
DRAINAGE COLLECTED FROM LAYER 2	0 0104	37902 055	0 08
PERC /LEAKAGE THROUGH LAYER 4	0 000000	0 147	0 00
AVG HEAD ON TOP OF LAYER 3	0 0000		
CHANGE IN WATER STORAGE	0 000	-732 179	0 00
SOIL WATER AT START OF YEAR	4 413	16019628 000	
SOIL WATER AT END OF YEAR	4 413	16018896 000	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	0 0000	39 106	0 00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 27

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 101	0 000	0 554	0 000	0 029	0 000
	0 000	0 000	0 000	0 625	0 000	0 001
EVAPOTRANSPIRATION	0 455	1 185	2 548	1 220	2 406	1 740
	0 458	0 042	0 188	1 070	0 600	0 132
LATERAL DRAINAGE COLLECTED	0 0000	0 0012	0 0035	0 0008	0 0001	0 0002
FROM LAYER 2	0 0005	0 0000	0 0001	0 0000	0 0000	0 0000

PERCOLATION/LEAKAGE THROUGH	0 0000	0 0000	0 0000	0 0000	0 0000	0 0000
LAYER 4	0 0000	0 0000	0 0000	0 0000	0 0000	0 0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0 000	0 000	0 000	0 000	0 000	0 000
TOP OF LAYER 3	0 000	0 000	0 000	0 000	0 000	0 000
STD DEVIATION OF DAILY	0 000	0 000	0 000	0 000	0 000	0 000
HEAD ON TOP OF LAYER 3	0 000	0 000	0 000	0 000	0 000	0 000

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ANNUAL TOTALS FOR YEAR 27

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	48496820 000	100 00
RUNOFF	1 310	4756191 500	9 81
EVAPOTRANSPIRATION	12 043	43715412 000	90 14
DRAINAGE COLLECTED FROM LAYER 2	0 0065	23490 195	0 05
PERC /LEAKAGE THROUGH LAYER 4	0 000000	0 113	0 00
AVG HEAD ON TOP OF LAYER 3	0 0000		
CHANGE IN WATER STORAGE	0 000	1704 955	0 00
SOIL WATER AT START OF YEAR	4 413	16018896 000	
SOIL WATER AT END OF YEAR	4 413	16020601 000	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	0 0000	20 330	0 00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 28

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 101	0 000	0 554	0 000	0 029	0 000
	0 000	0 000	0 000	0 625	0 000	0 001
EVAPOTRANSPIRATION	0 456	1 225	2 609	1 133	2 391	1 739
	0 474	0 026	0 191	1 085	0 582	0 131
LATERAL DRAINAGE COLLECTED	0 0000	0 0009	0 0032	0 0008	0 0014	0 0011
FROM LAYER 2	0 0000	0 0001	0 0000	0 0000	0 0000	0 0000
PERCOLATION/LEAKAGE THROUGH	0 0000	0 0000	0 0000	0 0000	0 0000	0 0000
LAYER 4	0 0000	0 0000	0 0000	0 0000	0 0000	0 0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0 000	0 000	0 000	0 000	0 000	0 000
TOP OF LAYER 3	0 000	0 000	0 000	0 000	0 000	0 000
STD DEVIATION OF DAILY	0 000	0 000	0 000	0 000	0 000	0 000
HEAD ON TOP OF LAYER 3	0 000	0 000	0 000	0 000	0 000	0 000

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ANNUAL TOTALS FOR YEAR 28

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	48496820 000	100 00
RUNOFF	1 310	4756200 500	9 81
EVAPOTRANSPIRATION	12 042	43712924 000	90 14
DRAINAGE COLLECTED FROM LAYER 2	0 0075	27346 297	0 06
PERC /LEAKAGE THROUGH LAYER 4	0 000000	0 132	0 00
AVG HEAD ON TOP OF LAYER 3	0 0000		

CHANGE IN WATER STORAGE	0 000	339 260	0 00
SOIL WATER AT START OF YEAR	4 413	16020601 000	
SOIL WATER AT END OF YEAR	4 413	16020940 000	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	0 0000	10 311	0 00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 29

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 101	0 000	0 554	0 000	0 029	0 000
	0 000	0 000	0 000	0 625	0 000	0 001
EVAPOTRANSPIRATION	0 456	1 186	2 549	1 219	2 404	1 739
	0 458	0 042	0 188	1 070	0 600	0 132
LATERAL DRAINAGE COLLECTED	0 0000	0 0008	0 0028	0 0014	0 0015	0 0008
FROM LAYER 2	0 0000	0 0000	0 0001	0 0000	0 0000	0 0000
PERCOLATION/LEAKAGE THROUGH	0 0000	0 0000	0 0000	0 0000	0 0000	0 0000
LAYER 4	0 0000	0 0000	0 0000	0 0000	0 0000	0 0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0 000	0 000	0 000	0 000	0 000	0 000
TOP OF LAYER 3	0 000	0 000	0 000	0 000	0 000	0 000
STD DEVIATION OF DAILY	0 000	0 000	0 000	0 000	0 000	0 000
HEAD ON TOP OF LAYER 3	0 000	0 000	0 000	0 000	0 000	0 000

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ANNUAL TOTALS FOR YEAR 29

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	48496820 000	100 00
RUNOFF	1 311	4757297 500	9 81
EVAPOTRANSPIRATION	12 043	43714744 000	90 14
DRAINAGE COLLECTED FROM LAYER 2	0 0073	26551 115	0 05
PERC /LEAKAGE THROUGH LAYER 4	0 000000	0 129	0 00
AVG HEAD ON TOP OF LAYER 3	0 0000		
CHANGE IN WATER STORAGE	0 000	-1794 963	0 00
SOIL WATER AT START OF YEAR	4 413	16020940 000	
SOIL WATER AT END OF YEAR	4 413	16019145 000	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	0 0000	21 389	0 00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 30

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 101	0 000	0 554	0 000	0 029	0 000
	0 000	0 000	0 000	0 625	0 000	0 001
EVAPOTRANSPIRATION	0 456	1 185	2 549	1 220	2 406	1 740
	0 458	0 042	0 188	1 069	0 600	0 132
LATERAL DRAINAGE COLLECTED	0 0000	0 0013	0 0021	0 0008	0 0005	0 0003
FROM LAYER 2	0 0000	0 0001	0 0000	0 0007	0 0000	0 0000

PERCOLATION/LEAKAGE THROUGH	0 0000	0 0000	0 0000	0 0000	0 0000	0 0000
LAYER 4	0 0000	0 0000	0 0000	0 0000	0 0000	0 0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0 000	0 000	0 000	0 000	0 000	0 000
TOP OF LAYER 3	0 000	0 000	0 000	0 000	0 000	0 000
STD DEVIATION OF DAILY	0 000	0 000	0 000	0 000	0 000	0 000
HEAD ON TOP OF LAYER 3	0 000	0 000	0 000	0 000	0 000	0 000

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ANNUAL TOTALS FOR YEAR 30

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	48496820 000	100 00
RUNOFF	1 310	4756208 000	9 81
EVAPOTRANSPIRATION	12 044	43717948 000	90 15
DRAINAGE COLLECTED FROM LAYER 2	0 0057	20855 004	0 04
PERC /LEAKAGE THROUGH LAYER 4	0 000000	0 087	0 00
AVG HEAD ON TOP OF LAYER 3	0 0000		
CHANGE IN WATER STORAGE	0 000	1798 425	0 00
SOIL WATER AT START OF YEAR	4 413	16019145 000	
SOIL WATER AT END OF YEAR	4 413	16020944 000	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	0 0000	11 570	0 00

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 30

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
STD DEVIATIONS	0 00	0 00	0 00	0 00	0 00	0 00
	0 00	0 00	0 00	0 00	0 00	0 00
RUNOFF						
TOTALS	0 098	0 000	0 554	0 000	0 030	0 000
	0 000	0 000	0 000	0 631	0 000	0 001
STD DEVIATIONS	0 008	0 000	0 003	0 000	0 004	0 000
	0 000	0 000	0 000	0 016	0 000	0 000
EVAPOTRANSPIRATION						
TOTALS	0 465	1 169	2 550	1 189	2 400	1 739
	0 462	0 038	0 188	1 092	0 597	0 133
STD DEVIATIONS	0 039	0 112	0 049	0 055	0 031	0 001
	0 007	0 007	0 003	0 098	0 011	0 009
LATERAL DRAINAGE COLLECTED FROM LAYER 2						
TOTALS	0 0000	0 0010	0 0023	0 0007	0 0019	0 0008
	0 0002	0 0001	0 0001	0 0002	0 0004	0 0001
STD DEVIATIONS	0 0001	0 0005	0 0012	0 0007	0 0020	0 0008
	0 0004	0 0001	0 0000	0 0003	0 0007	0 0002
PERCOLATION/LEAKAGE THROUGH LAYER 4						
TOTALS	0 0000	0 0000	0 0000	0 0000	0 0000	0 0000
	0 0000	0 0000	0 0000	0 0000	0 0000	0 0000
STD DEVIATIONS	0 0000	0 0000	0 0000	0 0000	0 0000	0 0000
	0 0000	0 0000	0 0000	0 0000	0 0000	0 0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
DAILY AVERAGE HEAD ON TOP OF LAYER 3						
AVERAGES	0 0000	0 0000	0 0000	0 0000	0 0000	0 0000
	0 0000	0 0000	0 0000	0 0000	0 0000	0 0000

STD DEVIATIONS	0 0000	0 0000	0 0000	0 0000	0 0000	0 0000
	0 0000	0 0000	0 0000	0 0000	0 0000	0 0000

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AVERAGE ANNUAL TOTALS & (STD DEVIATIONS) FOR YEARS 1 THROUGH 30

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36 (0 000)	48496828 0	100 00
RUNOFF	1 314 (0 0135)	4771297 00	9 838
EVAPOTRANSPIRATION	12 022 (0 1021)	43640720 00	89 987
LATERAL DRAINAGE COLLECTED FROM LAYER 2	0 00786 (0 00263)	28515 686	0 05880
PERCOLATION/LEAKAGE THROUGH LAYER 4	0 00000 (0 00000)	0 136	0 00000
AVERAGE HEAD ON TOP OF LAYER 3	0 000 (0 000)		
CHANGE IN WATER STORAGE	0 016 (0 0960)	56265 08	0 116

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PEAK DAILY VALUES FOR YEARS 1 THROUGH 30

	(INCHES)	(CU FT)
PRECIPITATION	1 10	3993000 000
RUNOFF	0 682	2475487 0000
DRAINAGE COLLECTED FROM LAYER 2	0 00069	2516 32080
PERCOLATION/LEAKAGE THROUGH LAYER 4	0 000000	0 03123
AVERAGE HEAD ON TOP OF LAYER 3	0 000	
MAXIMUM HEAD ON TOP OF LAYER 3	0 559	
LOCATION OF MAXIMUM HEAD IN LAYER 2 (DISTANCE FROM DRAIN)	0 0 FEET	
SNOW WATER	0 79	2858422 7500

MAXIMUM VEG SOIL WATER (VOL/VOL) 0 2520

MINIMUM VEG SOIL WATER (VOL/VOL) 0 1350

*** Maximum heads are computed using McEnroe's equations ***

Reference Maximum Saturated Depth over Landfill Liner
by Bruce M McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol 119, No 2, March 1993, pp 262-270

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FINAL WATER STORAGE AT END OF YEAR 30

LAYER	(INCHES)	(VOL/VOL)
1	4 2387	0 2355
2	0 0023	0 0100
3	0 0000	0 0000
4	0 1725	0 7500
SNOW WATER	0 000	

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LEACHATE COLLECTION SYSTEM CALCULATIONS

Flow Through Leachate Collection Layer

From the puncture analysis the maximum aggregate size is 3/4'

If the coefficient of permeability (K) is
1 cm/sec or 1 97 ft/min

Using Darcy's Law

Q=kia

If i=0 05ft/ft which is equal to the minimum slope
If a=1 ft^2 for a minimum of 1 foot of head over the cover

Q=(1 97 ft/min)*(0 05 ft/ft)*(1 ft_2)
Q=0 0985 ft^3/min or 0 74 gal/min

EVAPORATION BASIN CALCULATIONS

HELP MODELING

```
******************************************************************************
******************************************************************************
**                                                                          **
**                                                                          **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE               **
**                HELP MODEL VERSION 3 07  (1 NOVEMBER 1997)                **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY                   **
**                    USAE WATERWAYS EXPERIMENT STATION                     **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY              **
**                                                                          **
**                                                                          **
******************************************************************************
******************************************************************************


PRECIPITATION DATA FILE      x \shire\help\proprecp D4
TEMPERATURE DATA FILE        x \shire\help\protemp D7
SOLAR RADIATION DATA FILE    x \shire\help\prosolar D13
EVAPOTRANSPIRATION DATA      x \shire\help\evapo12 D11
SOIL AND DESIGN DATA FILE    x \shire\help\evapba D10
OUTPUT DATA FILE             x \shire\help\evapbaot OUT


TIME   14 45     DATE    8/ 6/2003


******************************************************************************

     TITLE   Evaporation Basin

******************************************************************************


     NOTE   INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE
              COMPUTED AS NEARLY STEADY-STATE VALUES BY THE PROGRAM


                                  LAYER  1
                                  --------

                       TYPE 1 - VERTICAL PERCOLATION LAYER
                          MATERIAL TEXTURE NUMBER   0
           THICKNESS                    =     12 00   INCHES
           POROSITY                     =      0 3980 VOL/VOL
           FIELD CAPACITY               =      0 2440 VOL/VOL
           WILTING POINT                =      0 1360 VOL/VOL
           INITIAL SOIL WATER CONTENT   =      0 2061 VOL/VOL
           EFFECTIVE SAT  HYD  COND     =  0 999999975000E-05 CM/SEC
```

LAYER 2

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 18

THICKNESS	=	180 00	INCHES
POROSITY	=	0 6710	VOL/VOL
FIELD CAPACITY	=	0 2920	VOL/VOL
WILTING POINT	=	0 0770	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0 2920	VOL/VOL
EFFECTIVE SAT HYD COND	=	0 100000005000E-02	CM/SEC

LAYER 3

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	24 00	INCHES
POROSITY	=	0 3970	VOL/VOL
FIELD CAPACITY	=	0 0320	VOL/VOL
WILTING POINT	=	0 0130	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0 0330	VOL/VOL
EFFECTIVE SAT HYD COND	=	1 00000000000	CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED

SCS RUNOFF CURVE NUMBER	=	92 00	
FRACTION OF AREA ALLOWING RUNOFF	=	0 0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	20 000	ACRES
EVAPORATIVE ZONE DEPTH	=	12 0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	2 473	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4 776	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1 632	INCHES
INITIAL SNOW WATER	=	0 000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	55 825	INCHES
TOTAL INITIAL WATER	=	55 825	INCHES
TOTAL SUBSURFACE INFLOW	=	0 00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
SALT LAKE CITY UTAH

STATION LATITUDE	=	40 76 DEGREES
MAXIMUM LEAF AREA INDEX	=	1 60
START OF GROWING SEASON (JULIAN DATE)	=	117
END OF GROWING SEASON (JULIAN DATE)	=	289
EVAPORATIVE ZONE DEPTH	=	12 0 INCHES
AVERAGE ANNUAL WIND SPEED	=	8 80 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	67 00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	48 00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	39 00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	65 00 %

NOTE PRECIPITATION DATA FOR Bear River Refuge Utah
WAS ENTERED BY THE USER

NOTE TEMPERATURE DATA FOR Salt Lake City Utah
WAS ENTERED BY THE USER

NOTE SOLAR RADIATION DATA FOR Salt Lake City Utah
WAS ENTERED BY THE USER

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 000	0 000	0 000	0 000	0 000	0 000
	0 000	0 000	0 000	0 000	0 000	0 000
EVAPOTRANSPIRATION	0 764	0 772	2 918	1 257	2 692	1 740
	0 451	0 049	0 159	1 586	0 703	0 229
PERCOLATION/LEAKAGE THROUGH	0 0081	0 0061	0 0053	0 0043	0 0006	0 0000
LAYER 3	0 0012	0 0028	0 0065	0 0069	0 0055	0 0044

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ANNUAL TOTALS FOR YEAR 1

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	969936 375	100 00
RUNOFF	0 000	0 000	0 00
EVAPOTRANSPIRATION	13 322	967178 937	99 72
PERC /LEAKAGE THROUGH LAYER 3	0 051718	3754 724	0 39
CHANGE IN WATER STORAGE	-0 014	-997 840	-0 10
SOIL WATER AT START OF YEAR	55 825	4052894 250	
SOIL WATER AT END OF YEAR	55 811	4051896 500	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	0 0000	0 540	0 00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 000	0 000	0 000	0 000	0 000	0 000
	0 000	0 000	0 000	0 000	0 000	0 000
EVAPOTRANSPIRATION	0 762	0 773	2 815	1 257	2 730	1 740
	0 451	0 049	0 160	1 583	0 704	0 229
PERCOLATION/LEAKAGE THROUGH	0 0000	0 0002	0 0020	0 0026	0 0007	0 0000
LAYER 3	0 0017	0 0081	0 0104	0 0112	0 0105	0 0100

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ANNUAL TOTALS FOR YEAR 2

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	969936 375	100 00
RUNOFF	0 000	0 000	0 00
EVAPOTRANSPIRATION	13 252	962131 187	99 20
PERC /LEAKAGE THROUGH LAYER 3	0 057568	4179 409	0 43
CHANGE IN WATER STORAGE	0 050	3626 067	0 37
SOIL WATER AT START OF YEAR	55 811	4051896 500	
SOIL WATER AT END OF YEAR	55 861	4055522 500	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	0 0000	-0 278	0 00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 3

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 000	0 000	0 000	0 000	0 000	0 000
	0 000	0 000	0 000	0 000	0 000	0 000
EVAPOTRANSPIRATION	0 761	0 773	2 814	1 257	2 738	1 740
	0 451	0 049	0 160	1 583	0 704	0 229
PERCOLATION/LEAKAGE THROUGH	0 0118	0 0094	0 0057	0 0053	0 0034	0 0001
LAYER 3	0 0067	0 0119	0 0126	0 0124	0 0111	0 0104

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ANNUAL TOTALS FOR YEAR 3

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	969936 375	100 00
RUNOFF	0 000	0 000	0 00
EVAPOTRANSPIRATION	13 259	962590 375	99 24
PERC /LEAKAGE THROUGH LAYER 3	0 100925	7327 130	0 76
CHANGE IN WATER STORAGE	0 000	18 555	0 00
SOIL WATER AT START OF YEAR	55 861	4055522 500	
SOIL WATER AT END OF YEAR	55 861	4055541 000	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	0 0000	0 334	0 00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 4

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 000	0 000	0 000	0 000	0 000	0 000
	0 000	0 000	0 000	0 000	0 000	0 000
EVAPOTRANSPIRATION	0 793	0 796	2 741	1 230	2 723	1 740
	0 472	0 028	0 164	1 601	0 692	0 217
PERCOLATION/LEAKAGE THROUGH	0 0123	0 0095	0 0084	0 0064	0 0020	0 0027
LAYER 3	0 0201	0 0230	0 0197	0 0174	0 0144	0 0128

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ANNUAL TOTALS FOR YEAR 4

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	969936 375	100 00
RUNOFF	0 000	0 000	0 00
EVAPOTRANSPIRATION	13 199	958224 437	98 79
PERC /LEAKAGE THROUGH LAYER 3	0 148864	10807 523	1 11
CHANGE IN WATER STORAGE	0 012	904 232	0 09
SOIL WATER AT START OF YEAR	55 861	4055541 000	
SOIL WATER AT END OF YEAR	55 874	4056445 250	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	0 0000	0 196	0 00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 5

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 000	0 000	0 000	0 000	0 000	0 000
	0 000	0 000	0 000	0 000	0 000	0 000
EVAPOTRANSPIRATION	0 762	0 773	2 814	1 257	2 734	1 740
	0 451	0 049	0 160	1 582	0 704	0 229
PERCOLATION/LEAKAGE THROUGH	0 0112	0 0119	0 0078	0 0069	0 0039	0 0007
LAYER 3	0 0094	0 0140	0 0139	0 0133	0 0117	0 0108

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ANNUAL TOTALS FOR YEAR 5

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	969936 375	100 00
RUNOFF	0 000	0 000	0 00
EVAPOTRANSPIRATION	13 255	962308 250	99 21
PERC /LEAKAGE THROUGH LAYER 3	0 115520	8386 717	0 86
CHANGE IN WATER STORAGE	-0 010	-759 112	-0 08
SOIL WATER AT START OF YEAR	55 874	4056445 250	
SOIL WATER AT END OF YEAR	55 863	4055686 250	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	0 0000	0 554	0 00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 6

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 000	0 000	0 000	0 000	0 000	0 000
	0 000	0 000	0 000	0 000	0 000	0 000
EVAPOTRANSPIRATION	0 793	0 785	2 711	1 257	2 739	1 740
	0 451	0 049	0 160	1 583	0 704	0 229
PERCOLATION/LEAKAGE THROUGH	0 0124	0 0096	0 0086	0 0066	0 0022	0 0025
LAYER 3	0 0199	0 0230	0 0197	0 0174	0 0144	0 0128

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ANNUAL TOTALS FOR YEAR 6

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	969936 375	100 00
RUNOFF	0 000	0 000	0 00
EVAPOTRANSPIRATION	13 200	958339 812	98 80
PERC /LEAKAGE THROUGH LAYER 3	0 149169	10829 702	1 12
CHANGE IN WATER STORAGE	0 011	766 312	0 08
SOIL WATER AT START OF YEAR	55 863	4055686 250	
SOIL WATER AT END OF YEAR	55 874	4056452 500	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	0 0000	0 589	0 00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 7

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 000	0 000	0 000	0 000	0 000	0 000
	0 000	0 000	0 000	0 000	0 000	0 000
EVAPOTRANSPIRATION	0 793	0 785	2 711	1 257	2 737	1 740
	0 451	0 049	0 160	1 583	0 704	0 229
PERCOLATION/LEAKAGE THROUGH	0 0112	0 0119	0 0106	0 0078	0 0027	0 0041
LAYER 3	0 0227	0 0243	0 0203	0 0177	0 0146	0 0129

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ANNUAL TOTALS FOR YEAR 7

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	969936 375	100 00
RUNOFF	0 000	0 000	0 00
EVAPOTRANSPIRATION	13 199	958220 125	98 79
PERC /LEAKAGE THROUGH LAYER 3	0 160931	11683 605	1 20
CHANGE IN WATER STORAGE	0 000	32 126	0 00
SOIL WATER AT START OF YEAR	55 874	4056452 500	
SOIL WATER AT END OF YEAR	55 874	4056484 500	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	0 0000	0 513	0 00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 8

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 000	0 000	0 000	0 000	0 000	0 000
	0 000	0 000	0 000	0 000	0 000	0 000
EVAPOTRANSPIRATION	0 793	0 796	2 741	1 230	2 725	1 740
	0 472	0 028	0 164	1 601	0 692	0 217
PERCOLATION/LEAKAGE THROUGH	0 0113	0 0123	0 0106	0 0079	0 0024	0 0047
LAYER 3	0 0226	0 0238	0 0200	0 0175	0 0144	0 0128

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ANNUAL TOTALS FOR YEAR 8

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	969936 375	100 00
RUNOFF	0 000	0 000	0 00
EVAPOTRANSPIRATION	13 201	958363 062	98 81
PERC /LEAKAGE THROUGH LAYER 3	0 160241	11633 533	1 20
CHANGE IN WATER STORAGE	-0 001	-60 651	-0 01
SOIL WATER AT START OF YEAR	55 874	4056484 500	
SOIL WATER AT END OF YEAR	55 874	4056424 000	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	0 0000	0 458	0 00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 9

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 000	0 000	0 000	0 000	0 000	0 000
	0 000	0 000	0 000	0 000	0 000	0 000
EVAPOTRANSPIRATION	0 762	0 773	2 814	1 257	2 738	1 740
	0 451	0 049	0 160	1 583	0 704	0 229
PERCOLATION/LEAKAGE THROUGH	0 0112	0 0119	0 0077	0 0069	0 0038	0 0007
LAYER 3	0 0090	0 0133	0 0133	0 0129	0 0114	0 0105

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ANNUAL TOTALS FOR YEAR 9

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	969936 375	100 00
RUNOFF	0 000	0 000	0 00
EVAPOTRANSPIRATION	13 259	962621 187	99 25
PERC /LEAKAGE THROUGH LAYER 3	0 112651	8178 437	0 84
CHANGE IN WATER STORAGE	-0 012	-863 798	-0 09
SOIL WATER AT START OF YEAR	55 874	4056424 000	
SOIL WATER AT END OF YEAR	55 862	4055560 000	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	0 0000	0 570	0 00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 10

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 000	0 000	0 000	0 000	0 000	0 000
	0 000	0 000	0 000	0 000	0 000	0 000
EVAPOTRANSPIRATION	0 793	0 785	2 711	1 257	2 739	1 740
	0 451	0 049	0 160	1 583	0 704	0 229
PERCOLATION/LEAKAGE THROUGH	0 0125	0 0093	0 0084	0 0065	0 0023	0 0022
LAYER 3	0 0194	0 0228	0 0197	0 0174	0 0144	0 0128

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ANNUAL TOTALS FOR YEAR 10

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	969936 375	100 00
RUNOFF	0 000	0 000	0 00
EVAPOTRANSPIRATION	13 200	958324 000	98 80
PERC /LEAKAGE THROUGH LAYER 3	0 147571	10713 625	1 10
CHANGE IN WATER STORAGE	0 012	898 139	0 09
SOIL WATER AT START OF YEAR	55 862	4055560 000	
SOIL WATER AT END OF YEAR	55 874	4056458 250	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	0 0000	0 624	0 00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 11

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 000	0 000	0 000	0 000	0 000	0 000
	0 000	0 000	0 000	0 000	0 000	0 000
EVAPOTRANSPIRATION	0 793	0 785	2 711	1 257	2 739	1 740
	0 451	0 049	0 160	1 583	0 704	0 229
PERCOLATION/LEAKAGE THROUGH	0 0112	0 0119	0 0106	0 0079	0 0026	0 0041
LAYER 3	0 0223	0 0239	0 0201	0 0176	0 0145	0 0128

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ANNUAL TOTALS FOR YEAR 11

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	969936 375	100 00
RUNOFF	0 000	0 000	0 00
EVAPOTRANSPIRATION	13 201	958364 187	98 81
PERC /LEAKAGE THROUGH LAYER 3	0 159476	11577 944	1 19
CHANGE IN WATER STORAGE	0 000	-6 370	0 00
SOIL WATER AT START OF YEAR	55 874	4056458 250	
SOIL WATER AT END OF YEAR	55 874	4056452 000	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	0 0000	0 657	0 00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 12

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 000	0 000	0 000	0 000	0 000	0 000
	0 000	0 000	0 000	0 000	0 000	0 000
EVAPOTRANSPIRATION	0 793	0 796	2 741	1 230	2 726	1 740
	0 472	0 028	0 164	1 601	0 692	0 217
PERCOLATION/LEAKAGE THROUGH	0 0112	0 0123	0 0105	0 0078	0 0022	0 0046
LAYER 3	0 0224	0 0237	0 0199	0 0174	0 0144	0 0128

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ANNUAL TOTALS FOR YEAR 12

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	969936 375	100 00
RUNOFF	0 000	0 000	0 00
EVAPOTRANSPIRATION	13 201	958402 187	98 81
PERC /LEAKAGE THROUGH LAYER 3	0 159173	11555 960	1 19
CHANGE IN WATER STORAGE	0 000	-22 156	0 00
SOIL WATER AT START OF YEAR	55 874	4056452 000	
SOIL WATER AT END OF YEAR	55 874	4056429 750	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	0 0000	0 417	0 00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 13

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 000	0 000	0 000	0 000	0 000	0 000
	0 000	0 000	0 000	0 000	0 000	0 000
EVAPOTRANSPIRATION	0 793	0 785	2 712	1 257	2 738	1 740
	0 451	0 049	0 160	1 582	0 703	0 229
PERCOLATION/LEAKAGE THROUGH	0 0112	0 0120	0 0104	0 0074	0 0026	0 0042
LAYER 3	0 0225	0 0240	0 0202	0 0176	0 0145	0 0129

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ANNUAL TOTALS FOR YEAR 13

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	969936 375	100 00
RUNOFF	0 000	0 000	0 00
EVAPOTRANSPIRATION	13 200	958299 562	98 80
PERC /LEAKAGE THROUGH LAYER 3	0 159663	11591 533	1 20
CHANGE IN WATER STORAGE	0 001	44 312	0 00
SOIL WATER AT START OF YEAR	55 874	4056429 750	
SOIL WATER AT END OF YEAR	55 874	4056474 000	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	0 0000	0 984	0 00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 14

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 000	0 000	0 000	0 000	0 000	0 000
	0 000	0 000	0 000	0 000	0 000	0 000
EVAPOTRANSPIRATION	0 793	0 785	2 711	1 257	2 738	1 740
	0 451	0 049	0 160	1 583	0 703	0 229
PERCOLATION/LEAKAGE THROUGH	0 0113	0 0118	0 0107	0 0079	0 0027	0 0041
LAYER 3	0 0225	0 0241	0 0202	0 0176	0 0145	0 0129

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ANNUAL TOTALS FOR YEAR 14

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	969936 375	100 00
RUNOFF	0 000	0 000	0 00
EVAPOTRANSPIRATION	13 200	958308 437	98 80
PERC /LEAKAGE THROUGH LAYER 3	0 160397	11644 796	1 20
CHANGE IN WATER STORAGE	0 000	-16 894	0 00
SOIL WATER AT START OF YEAR	55 874	4056474 000	
SOIL WATER AT END OF YEAR	55 874	4056457 250	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	0 0000	0 065	0 00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 15

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 000	0 000	0 000	0 000	0 000	0 000
	0 000	0 000	0 000	0 000	0 000	0 000
EVAPOTRANSPIRATION	0 761	0 773	2 814	1 257	2 739	1 740
	0 451	0 049	0 160	1 583	0 704	0 229
PERCOLATION/LEAKAGE THROUGH	0 0113	0 0119	0 0089	0 0075	0 0035	0 0003
LAYER 3	0 0080	0 0129	0 0132	0 0128	0 0114	0 0106

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ANNUAL TOTALS FOR YEAR 15

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	969936 375	100 00
RUNOFF	0 000	0 000	0 00
EVAPOTRANSPIRATION	13 260	962645 625	99 25
PERC /LEAKAGE THROUGH LAYER 3	0 112342	8156 010	0 84
CHANGE IN WATER STORAGE	-0 012	-865 736	-0 09
SOIL WATER AT START OF YEAR	55 874	4056457 250	
SOIL WATER AT END OF YEAR	55 862	4055591 500	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	0 0000	0 495	0 00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 16

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 000	0 000	0 000	0 000	0 000	0 000
	0 000	0 000	0 000	0 000	0 000	0 000
EVAPOTRANSPIRATION	0 761	0 784	2 844	1 230	2 714	1 740
	0 472	0 028	0 164	1 601	0 692	0 217
PERCOLATION/LEAKAGE THROUGH	0 0124	0 0096	0 0055	0 0057	0 0032	0 0003
LAYER 3	0 0081	0 0138	0 0140	0 0135	0 0119	0 0110

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ANNUAL TOTALS FOR YEAR 16

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	969936 375	100 00
RUNOFF	0 000	0 000	0 00
EVAPOTRANSPIRATION	13 248	961818 125	99 16
PERC /LEAKAGE THROUGH LAYER 3	0 108908	7906 748	0 82
CHANGE IN WATER STORAGE	0 003	211 588	0 02
SOIL WATER AT START OF YEAR	55 862	4055591 500	
SOIL WATER AT END OF YEAR	55 865	4055803 000	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	0 0000	-0 049	0 00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 17

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 000	0 000	0 000	0 000	0 000	0 000
	0 000	0 000	0 000	0 000	0 000	0 000
EVAPOTRANSPIRATION	0 793	0 785	2 712	1 257	2 739	1 740
	0 451	0 049	0 160	1 583	0 704	0 229
PERCOLATION/LEAKAGE THROUGH	0 0121	0 0100	0 0089	0 0068	0 0023	0 0026
LAYER 3	0 0200	0 0229	0 0197	0 0173	0 0144	0 0128

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ANNUAL TOTALS FOR YEAR 17

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	969936 375	100 00
RUNOFF	0 000	0 000	0 00
EVAPOTRANSPIRATION	13 202	958441 000	98 81
PERC /LEAKAGE THROUGH LAYER 3	0 149834	10877 965	1 12
CHANGE IN WATER STORAGE	0 008	616 484	0 06
SOIL WATER AT START OF YEAR	55 865	4055803 000	
SOIL WATER AT END OF YEAR	55 874	4056419 500	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	0 0000	0 929	0 00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 18

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 000	0 000	0 000	0 000	0 000	0 000
	0 000	0 000	0 000	0 000	0 000	0 000
EVAPOTRANSPIRATION	0 761	0 773	2 814	1 257	2 739	1 740
	0 451	0 049	0 160	1 583	0 704	0 229
PERCOLATION/LEAKAGE THROUGH	0 0112	0 0119	0 0077	0 0069	0 0038	0 0007
LAYER 3	0 0089	0 0132	0 0132	0 0128	0 0113	0 0105

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ANNUAL TOTALS FOR YEAR 18

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	969936 375	100 00
RUNOFF	0 000	0 000	0 00
EVAPOTRANSPIRATION	13 260	962671 312	99 25
PERC /LEAKAGE THROUGH LAYER 3	0 112215	8146 799	0 84
CHANGE IN WATER STORAGE	-0 012	-882 076	-0 09
SOIL WATER AT START OF YEAR	55 874	4056419 500	
SOIL WATER AT END OF YEAR	55 861	4055537 500	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	0 0000	0 359	0 00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 19

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 000	0 000	0 000	0 000	0 000	0 000
	0 000	0 000	0 000	0 000	0 000	0 000
EVAPOTRANSPIRATION	0 793	0 785	2 711	1 257	2 737	1 740
	0 451	0 049	0 160	1 583	0 703	0 229
PERCOLATION/LEAKAGE THROUGH	0 0126	0 0092	0 0083	0 0063	0 0022	0 0024
LAYER 3	0 0196	0 0231	0 0199	0 0175	0 0145	0 0129

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ANNUAL TOTALS FOR YEAR 19

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	969936 375	100 00
RUNOFF	0 000	0 000	0 00
EVAPOTRANSPIRATION	13 198	958190 375	98 79
PERC /LEAKAGE THROUGH LAYER 3	0 148508	10781 694	1 11
CHANGE IN WATER STORAGE	0 013	964 053	0 10
SOIL WATER AT START OF YEAR	55 861	4055537 500	
SOIL WATER AT END OF YEAR	55 875	4056501 500	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	0 0000	0 268	0 00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 20

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 000	0 000	0 000	0 000	0 000	0 000
	0 000	0 000	0 000	0 000	0 000	0 000
EVAPOTRANSPIRATION	0 793	0 796	2 741	1 230	2 725	1 740
	0 472	0 028	0 164	1 601	0 692	0 217
PERCOLATION/LEAKAGE THROUGH	0 0113	0 0122	0 0106	0 0079	0 0024	0 0047
LAYER 3	0 0227	0 0239	0 0200	0 0175	0 0144	0 0128

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ANNUAL TOTALS FOR YEAR 20

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	969936 375	100 00
RUNOFF	0 000	0 000	0 00
EVAPOTRANSPIRATION	13 201	958370 812	98 81
PERC /LEAKAGE THROUGH LAYER 3	0 160375	11643 197	1 20
CHANGE IN WATER STORAGE	-0 001	-78 099	-0 01
SOIL WATER AT START OF YEAR	55 875	4056501 500	
SOIL WATER AT END OF YEAR	55 874	4056423 250	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	0 0000	0 487	0 00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 21

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 000	0 000	0 000	0 000	0 000	0 000
	0 000	0 000	0 000	0 000	0 000	0 000
EVAPOTRANSPIRATION	0 762	0 773	2 814	1 257	2 737	1 740
	0 451	0 049	0 160	1 583	0 704	0 229
PERCOLATION/LEAKAGE THROUGH	0 0112	0 0119	0 0077	0 0069	0 0039	0 0007
LAYER 3	0 0089	0 0134	0 0134	0 0130	0 0115	0 0106

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ANNUAL TOTALS FOR YEAR 21

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	969936 375	100 00
RUNOFF	0 000	0 000	0 00
EVAPOTRANSPIRATION	13 258	962538 500	99 24
PERC /LEAKAGE THROUGH LAYER 3	0 113288	8224 722	0 85
CHANGE IN WATER STORAGE	-0 011	-826 964	-0 09
SOIL WATER AT START OF YEAR	55 874	4056423 250	
SOIL WATER AT END OF YEAR	55 862	4055596 500	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	0 0000	0 121	0 00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 22

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 000	0 000	0 000	0 000	0 000	0 000
	0 000	0 000	0 000	0 000	0 000	0 000
EVAPOTRANSPIRATION	0 793	0 785	2 711	1 257	2 739	1 740
	0 451	0 049	0 160	1 582	0 703	0 229
PERCOLATION/LEAKAGE THROUGH	0 0125	0 0094	0 0085	0 0064	0 0022	0 0025
LAYER 3	0 0197	0 0229	0 0197	0 0174	0 0144	0 0128

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ANNUAL TOTALS FOR YEAR 22

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	969936 375	100 00
RUNOFF	0 000	0 000	0 00
EVAPOTRANSPIRATION	13 200	958294 312	98 80
PERC /LEAKAGE THROUGH LAYER 3	0 148256	10763 382	1 11
CHANGE IN WATER STORAGE	0 012	878 476	0 09
SOIL WATER AT START OF YEAR	55 862	4055596 500	
SOIL WATER AT END OF YEAR	55 874	4056474 750	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	0 0000	0 234	0 00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 23

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 000	0 000	0 000	0 000	0 000	0 000
	0 000	0 000	0 000	0 000	0 000	0 000
EVAPOTRANSPIRATION	0 793	0 785	2 711	1 257	2 727	1 740
	0 451	0 049	0 160	1 583	0 704	0 229
PERCOLATION/LEAKAGE THROUGH	0 0112	0 0118	0 0085	0 0088	0 0031	0 0060
LAYER 3	0 0264	0 0262	0 0214	0 0183	0 0150	0 0132

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ANNUAL TOTALS FOR YEAR 23

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	969936 375	100 00
RUNOFF	0 000	0 000	0 00
EVAPOTRANSPIRATION	13 189	957525 000	98 72
PERC /LEAKAGE THROUGH LAYER 3	0 169945	12338 031	1 27
CHANGE IN WATER STORAGE	0 001	72 837	0 01
SOIL WATER AT START OF YEAR	55 874	4056474 750	
SOIL WATER AT END OF YEAR	55 875	4056547 750	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	0 0000	0 513	0 00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 24

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 000	0 000	0 000	0 000	0 000	0 000
	0 000	0 000	0 000	0 000	0 000	0 000
EVAPOTRANSPIRATION	0 761	0 784	2 844	1 230	2 723	1 740
	0 472	0 028	0 164	1 602	0 692	0 217
PERCOLATION/LEAKAGE THROUGH	0 0115	0 0122	0 0080	0 0073	0 0037	0 0009
LAYER 3	0 0095	0 0136	0 0135	0 0130	0 0114	0 0106

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ANNUAL TOTALS FOR YEAR 24

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	969936 375	100 00
RUNOFF	0 000	0 000	0 00
EVAPOTRANSPIRATION	13 259	962580 312	99 24
PERC /LEAKAGE THROUGH LAYER 3	0 115231	8365 775	0 86
CHANGE IN WATER STORAGE	-0 014	-1010 303	-0 10
SOIL WATER AT START OF YEAR	55 875	4056547 750	
SOIL WATER AT END OF YEAR	55 861	4055537 500	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	0 0000	0 587	0 00

MONTHLY TOTALS (IN INCHES) FOR YEAR 25

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 000	0 000	0 000	0 000	0 000	0 000
	0 000	0 000	0 000	0 000	0 000	0 000
EVAPOTRANSPIRATION	0 762	0 773	2 815	1 257	2 738	1 740
	0 451	0 049	0 160	1 583	0 704	0 229
PERCOLATION/LEAKAGE THROUGH	0 0126	0 0092	0 0056	0 0056	0 0032	0 0001
LAYER 3	0 0064	0 0116	0 0123	0 0123	0 0110	0 0103

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ANNUAL TOTALS FOR YEAR 25

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	969936 375	100 00
RUNOFF	0 000	0 000	0 00
EVAPOTRANSPIRATION	13 260	962697 000	99 25
PERC /LEAKAGE THROUGH LAYER 3	0 100357	7285 917	0 75
CHANGE IN WATER STORAGE	-0 001	-47 358	0 00
SOIL WATER AT START OF YEAR	55 861	4055537 500	
SOIL WATER AT END OF YEAR	55 861	4055490 000	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	0 0000	0 836	0 00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 26

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 000	0 000	0 000	0 000	0 000	0 000
	0 000	0 000	0 000	0 000	0 000	0 000
EVAPOTRANSPIRATION	0 761	0 773	2 814	1 257	2 689	1 740
	0 451	0 049	0 160	1 582	0 704	0 229
PERCOLATION/LEAKAGE THROUGH	0 0124	0 0091	0 0054	0 0051	0 0039	0 0005
LAYER 3	0 0154	0 0213	0 0191	0 0172	0 0143	0 0128

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ANNUAL TOTALS FOR YEAR 26

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	969936 375	100 00
RUNOFF	0 000	0 000	0 00
EVAPOTRANSPIRATION	13 210	959018 187	98 87
PERC /LEAKAGE THROUGH LAYER 3	0 136614	9918 177	1 02
CHANGE IN WATER STORAGE	0 014	999 502	0 10
SOIL WATER AT START OF YEAR	55 861	4055490 000	
SOIL WATER AT END OF YEAR	55 875	4056489 500	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	0 0000	0 542	0 00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 27

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 000	0 000	0 000	0 000	0 000	0 000
	0 000	0 000	0 000	0 000	0 000	0 000
EVAPOTRANSPIRATION	0 793	0 785	2 711	1 257	2 739	1 740
	0 451	0 049	0 160	1 582	0 703	0 229
PERCOLATION/LEAKAGE THROUGH	0 0112	0 0118	0 0107	0 0078	0 0026	0 0043
LAYER 3	0 0226	0 0241	0 0202	0 0176	0 0145	0 0129

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ANNUAL TOTALS FOR YEAR 27

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	969936 375	100 00
RUNOFF	0 000	0 000	0 00
EVAPOTRANSPIRATION	13 200	958306 375	98 80
PERC /LEAKAGE THROUGH LAYER 3	0 160351	11641 509	1 20
CHANGE IN WATER STORAGE	0 000	-11 632	0 00
SOIL WATER AT START OF YEAR	55 875	4056489 500	
SOIL WATER AT END OF YEAR	55 874	4056478 000	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	0 0000	0 167	0 00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 28

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 000	0 000	0 000	0 000	0 000	0 000
	0 000	0 000	0 000	0 000	0 000	0 000
EVAPOTRANSPIRATION	0 793	0 796	2 741	1 230	2 725	1 740
	0 472	0 028	0 164	1 601	0 692	0 217
PERCOLATION/LEAKAGE THROUGH	0 0113	0 0122	0 0075	0 0082	0 0029	0 0062
LAYER 3	0 0235	0 0241	0 0201	0 0175	0 0144	0 0128

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ANNUAL TOTALS FOR YEAR 28

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	969936 375	100 00
RUNOFF	0 000	0 000	0 00
EVAPOTRANSPIRATION	13 200	958349 812	98 81
PERC /LEAKAGE THROUGH LAYER 3	0 160532	11654 607	1 20
CHANGE IN WATER STORAGE	-0 001	-68 406	-0 01
SOIL WATER AT START OF YEAR	55 874	4056478 000	
SOIL WATER AT END OF YEAR	55 873	4056409 500	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	0 0000	0 361	0 00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 29

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 000	0 000	0 000	0 000	0 000	0 000
	0 000	0 000	0 000	0 000	0 000	0 000
EVAPOTRANSPIRATION	0 762	0 773	2 814	1 257	2 739	1 740
	0 451	0 049	0 160	1 583	0 704	0 229
PERCOLATION/LEAKAGE THROUGH	0 0112	0 0120	0 0077	0 0069	0 0037	0 0007
LAYER 3	0 0088	0 0131	0 0131	0 0127	0 0113	0 0104

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ANNUAL TOTALS FOR YEAR 29

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	969936 375	100 00
RUNOFF	0 000	0 000	0 00
EVAPOTRANSPIRATION	13 261	962724 500	99 26
PERC /LEAKAGE THROUGH LAYER 3	0 111590	8101 455	0 84
CHANGE IN WATER STORAGE	-0 012	-889 554	-0 09
SOIL WATER AT START OF YEAR	55 873	4056409 500	
SOIL WATER AT END OF YEAR	55 861	4055520 000	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	0 0000	0 008	0 00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 30

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
RUNOFF	0 000	0 000	0 000	0 000	0 000	0 000
	0 000	0 000	0 000	0 000	0 000	0 000
EVAPOTRANSPIRATION	0 793	0 785	2 711	1 257	2 739	1 740
	0 451	0 049	0 160	1 583	0 704	0 229
PERCOLATION/LEAKAGE THROUGH	0 0125	0 0092	0 0083	0 0064	0 0022	0 0022
LAYER 3	0 0193	0 0227	0 0196	0 0173	0 0144	0 0128

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ANNUAL TOTALS FOR YEAR 30

	INCHES	CU FEET	PERCENT
PRECIPITATION	13 36	969936 375	100 00
RUNOFF	0 000	0 000	0 00
EVAPOTRANSPIRATION	13 200	958340 812	98 80
PERC /LEAKAGE THROUGH LAYER 3	0 146918	10666 261	1 10
CHANGE IN WATER STORAGE	0 013	928 603	0 10
SOIL WATER AT START OF YEAR	55 861	4055520 000	
SOIL WATER AT END OF YEAR	55 874	4056448 500	
SNOW WATER AT START OF YEAR	0 000	0 000	0 00
SNOW WATER AT END OF YEAR	0 000	0 000	0 00
ANNUAL WATER BUDGET BALANCE	0 0000	0 700	0 00

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 30

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	0 92	0 78	3 09	1 25	1 55	1 74
	0 50	0 00	0 47	2 19	0 67	0 20
STD DEVIATIONS	0 00	0 00	0 00	0 00	0 00	0 00
	0 00	0 00	0 00	0 00	0 00	0 00
RUNOFF						
TOTALS	0 000	0 000	0 000	0 000	0 000	0 000
	0 000	0 000	0 000	0 000	0 000	0 000
STD DEVIATIONS	0 000	0 000	0 000	0 000	0 000	0 000
	0 000	0 000	0 000	0 000	0 000	0 000

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EVAPOTRANSPIRATION
------------------
  TOTALS                  0 779    0 782    2 766    1 251    2 731    1 740
                          0 456    0 044    0 161    1 587    0 701    0 227

  STD  DEVIATIONS         0 016    0 008    0 058    0 012    0 013    0 000
                          0 009    0 009    0 002    0 008    0 005    0 005

PERCOLATION/LEAKAGE THROUGH LAYER  3
------------------------------------
  TOTALS                  0 0112   0 0105   0 0082   0 0068   0 0028   0 0023
                          0 0157   0 0188   0 0170   0 0154   0 0130   0 0117

  STD  DEVIATIONS         0 0023   0 0025   0 0021   0 0013   0 0009   0 0019
                          0 0075   0 0062   0 0040   0 0029   0 0021   0 0018

*******************************************************************************


*******************************************************************************

   AVERAGE ANNUAL TOTALS & (STD  DEVIATIONS) FOR YEARS    1 THROUGH   30
-------------------------------------------------------------------------------
                                     INCHES              CU  FEET      PERCENT
                              -------------------    -------------   ---------
PRECIPITATION                   13 36     (   0 000)    969936 5      100 00

RUNOFF                           0 000    (  0 0000)         0 00       0 000

EVAPOTRANSPIRATION              13 225    (  0 0334)    960139 69      98 990

PERCOLATION/LEAKAGE THROUGH      0 13330 (  0 03073)     9677 896      0 99779
  LAYER  3

CHANGE IN WATER STORAGE          0 002    (  0 0129)       118 48       0 012
*******************************************************************************
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****

PEAK DAILY VALUES FOR YEARS 1 THROUGH 30

	(INCHES)	(CU FT)
PRECIPITATION	1 10	79860 000
RUNOFF	0 000	0 0000
PERCOLATION/LEAKAGE THROUGH LAYER 3	0 000907	65 84068
SNOW WATER	0 79	57168 4570

MAXIMUM VEG SOIL WATER (VOL/VOL)	0 3207
MINIMUM VEG SOIL WATER (VOL/VOL)	0 1360

****

****

FINAL WATER STORAGE AT END OF YEAR 30

LAYER	(INCHES)	(VOL/VOL)
1	2 4865	0 2072
2	52 5599	0 2920
3	0 8275	0 0345
SNOW WATER	0 000	

****
****

EVAPORATION BASIN CALCULATIONS

MASS BALANCE

Promontory Landfill Evaporation Basin Mass Balance

RAINFALL (IN)

Month	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
30-yr Average	1 19	1 18	1 41	1 49	1 74	0 85	0 66	1 13	1 45	1 84	1 19	1 17	15 30
Std Dev	0 62	0 78	1 00	1 41	1 14	0 91	0 78	1 03	1 59	1 23	1 05	0 95	12 49
25-yr (In)	2 28	2 55	3 16	3 96	3 74	2 44	2 03	2 93	4 23	3 99	3 03	2 83	37 16

LEACHATE (IN)

Month	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
Leachate	0 01	0 01	0 01	0 01	0 00	0 00	0 02	0 02	0 02	0 02	0 01	0 01	0 13
Std Dev	0 00	0 00	0 00	0 00	0 00	0 00	0 01	0 01	0 00	0 00	0 00	0 00	0 04
25-yr (In)	0 02	0 01	0 01	0 01	0 00	0 01	0 03	0 03	0 02	0 02	0 02	0 01	0 20

EVAPORATION (IN)

Month	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
30-yr Average	0 82	1 27	2 35	3 69	5 30	6 48	7 37	6 35	4 28	2 59	1 22	0 77	42 49
Std Dev	0 13	0 24	0 51	0 73	0 68	0 74	0 42	0 42	0 51	0 50	0 27	0 11	5 26
25-yr	0 59	0 85	1 46	2 41	4 11	5 19	6 64	5 62	3 39	1 72	0 75	0 58	33 29

Cell Area 20

Single Lagoon Size Requirments
Width 80 ft
Length 80 ft
Required Area 6400 sq ft ***0 15 acres***
Seepage 0 gal/acre/day

January

Month	Leachate		Rainfall		Evaporation		Seepage		Net Flow	Accum
	gal	cu ft.	inches	cu ft	inches	cu ft	gal	cu ft.	cu ft.	cu ft
JAN	6 082	813	2 28	1,213	0 59	316			1,710	4 419
FEB	5,702	762	1 18	629	1 27	677			714	5,133
MAR	4 453	595	1 41	752	2 35	1 253			94	5 227
APR	3 693	494	1 49	795	3 69	1 968			(680)	4 547
MAY	1 521	203	1 74	928	5 30	2 827			(1 695)	2,852
JUN	1 249	167	0 85	453	6 48	3 456			(2 836)	16
JUL	8,526	1 140	0 66	352	7 37	3,931			(2,439)	(2 423)
AUG	10 209	1 365	1 13	603	6 35	3 387			(1,419)	(3 842)
SEP	9 232	1 234	1 45	773	4 28	2 283			(275)	(4 118)
OCT	8 363	1 118	1 84	981	2 59	1 381			718	718
NOV	7 060	944	1 19	635	1 22	651			928	1 646
DEC	6 354	849	1 17	624	0 77	411			1,063	2 708
TOTAL	72 443	9 684	16 39	8 739	42 26	22 540			(4 118)	

February

Month	Leachate		Rainfall		Evaporation		Seepage		Net Flow	Accum
	gal	cu ft.	inches	cu ft.	inches	cu ft.	gal	cu ft	cu ft.	cu ft
JAN	6 082	813	1 19	635	0 82	437			1 010	3 719
FEB	5,702	762	2 55	1 357	0 85	453			1,666	5 385
MAR	4 453	595	1 41	752	2 35	1 253			94	5 479
APR	3 693	494	1 49	795	3 69	1,968			(680)	4 799
MAY	1 521	203	1 74	928	5 30	2,827			(1 695)	3 104
JUN	1 249	167	0 85	453	6 48	3,456			(2,836)	268
JUL	8 526	1,140	0 66	352	7 37	3 931			(2,439)	(2 171)
AUG	10,209	1,365	1 13	603	6 35	3 387			(1,419)	(3 590)
SEP	9,232	1,234	1 45	773	4 28	2 283			(275)	(3 866)
OCT	8 363	1,118	1 84	981	2 59	1 381			718	718
NOV	7 060	944	1 19	635	1 22	651			928	1,648
DEC	6 354	849	1 17	624	0 77	411			1,063	2 708
TOTAL	72 443	9 684	16 67	8 888	42 07	22 437			(3 866)	

March

Month	Leachate		Rainfall	Evaporation			Seepage		Net Flow	Accum
	gal	cu ft.	inches	cu ft	inches	cu ft.	gal	cu ft.	cu ft.	cu ft.
JAN	6,082	813	1 19	635	0 82	437			1,010	3 719
FEB	5 702	762	1 18	629	1 27	677			714	4 433
MAR	4,453	595	3 16	1,685	1 46	777			1,503	5,936
APR	3 693	494	1 49	795	3 69	1 968			(680)	5,256
MAY	1 521	203	1 74	928	5 30	2 827			(1,695)	3 561
JUN	1,249	167	0 85	453	6 48	3 456			(2 836)	725
JUL	8 526	1,140	0 66	352	7 37	3 931			(2 439)	(1 714)
AUG	10,209	1,365	1 13	603	6 35	3 387			(1 419)	(3 133)
SEP	9,232	1 234	1 45	773	4 28	2 283			(275)	(3 408)
OCT	8.363	1 118	1 84	981	2 59	1 381			718	718
NOV	7 060	944	1 19	635	1 22	651			928	1 646
DEC	6 354	849	1 17	624	0 77	411			1 063	2 708
TOTAL	72 443	9 684	17 05	9 093	41 60	22 185			(3 408)	

April

Month	Leachate		Rainfall	Evaporation			Seepage		Net Flow	Accum
	gal	cu ft	inches	cu ft	inches	cu ft	gal	cu ft	cu ft	cu ft
JAN	6 082	813	1 19	635	0 82	437			1,010	3 719
FEB	5 702	762	1 18	629	1 27	677			714	4 433
MAR	4 453	595	2 32	1,237	2 35	1 253			579	5,012
APR	3,693	494	4 96	2 645	2 41	1,285			1 854	6 868
MAY	1 521	203	1 74	928	5 30	2 827			(1,695)	5 170
JUN	1 249	167	0 85	453	6 48	3 456			(2 836)	2 334
JUL	8 526	1 140	0 66	352	7 37	3 931			(2,439)	(105)
AUG	10 209	1,365	1 13	603	6 35	3 387			(1 419)	(1 524)
SEP	9 232	1,234	1 45	773	4 28	2 283			(275)	(1 799)
OCT	8 363	1 118	1 84	981	2 59	1 381			718	718
NOV	7 060	944	1 19	635	1 22	651			928	1 646
DEC	6 354	849	1 17	624	0 77	411			1 063	2 708
TOTAL	72 443	9 684	19 68	10 496	41 21	21 979			(1 799)	

May

Month	Leachate		Rainfall	Evaporation			Seepage		Net Flow	Accum
	gal	cu ft	inches	cu ft.	inches	cu ft	gal	cu ft	cu ft	cu ft.
JAN	6 082	813	1 19	635	0 82	437			1,010	3 719
FEB	5,702	762	1 18	629	1 27	677			714	4 433
MAR	4 453	595	2 32	1 237	2 35	1 253			579	5.012
APR	3 693	494	2 49	1,328	3 69	1 968			(146)	4 866
MAY	1 521	203	3 91	2 085	4 11	2,192			97	4,962
JUN	1,249	167	0 85	453	6 48	3,456			(2 836)	2 126
JUL	8 526	1 140	0 66	352	7 37	3 931			(2 439)	(313)
AUG	10 209	1,365	1 13	603	6 35	3 387			(1,419)	(1,732)
SEP	9 232	1 234	1 45	773	4 28	2 283			(275)	(2,007)
OCT	8 363	1 118	1 84	981	2 59	1 381			718	718
NOV	7,060	944	1 19	635	1 22	651			928	1 646
DEC	6 354	849	1 17	624	0 77	411			1 063	2 708
TOTAL	72 443	9 684	19 38	10 336	41 30	22 027			(2 007)	

June

Month	Leachate		Rainfall	Evaporation			Seepage		Net Flow	Accum
	gal	cu ft	inches	cu ft	inchea	cu ft	gal	cu ft	cu ft	cu ft
JAN	6 082	813	1 19	635	0 82	437			1,010	3 719
FEB	5 702	762	1 18	629	1 27	677			714	4 433
MAR	4 453	595	2 32	1 237	2 35	1,253			579	5,012
APR	3 693	494	2 49	1,328	3 69	1 968			(146)	4,866
MAY	1 521	203	1 91	1 019	5 30	2 827			(1,605)	3 261
JUN	1 249	167	2 70	1,440	5 19	2 768			(1 161)	2 100
JUL	8,526	1 140	0 66	352	7 37	3 931			(2 439)	(339)
AUG	10,209	1 365	1 13	603	6 35	3 387			(1 419)	(1 758)
SEP	9 232	1 234	1 45	773	4 28	2 283			(275)	(2 034)
OCT	8 363	1 118	1 84	981	2 59	1 381			718	718
NOV	7,060	944	1 19	635	1 22	651			928	1,646
DEC	6 354	849	1 17	624	0 77	411			1 063	2 708
TOTAL	72 443	9 684	19 23	10 256	41 20	21 973			(2 034)	

July

Month	Leachate		Rainfall	Evaporation			Seepage		Net Flow	Accum
	gal	cu ft	inchea	cu ft	inches	cu ft.	gal	cu ft	cu ft	cu ft
JAN	6,082	813	1 19	635	0 82	437			1 010	3 719
FEB	5 702	762	1 18	629	1 27	677			714	4 433
MAR	4 453	595	2 32	1,237	2 35	1,253			579	5,012
APR	3 693	494	2 49	1 326	3 69	1,968			(146)	4 866
MAY	1 521	203	1 91	1 019	5 30	2 827			(1 605)	3,261
JUN	1 249	167	1 11	592	6 48	3 456			(2 697)	564
JUL	8 526	1 140	3 29	1 755	6 64	3 541			(647)	(83)
AUG	10 209	1,365	1 13	603	6 35	3 387			(1,419)	(1 502)
SEP	9 232	1,234	1 45	773	4 28	2 283			(275)	(1,778)
OCT	8 363	1,118	1 84	981	2 59	1 381			718	718
NOV	7,060	944	1 19	635	1 22	651			928	1 646
DEC	6 354	849	1 17	624	0 77	411			1 063	2 708
TOTAL	72 443	9 684	20 27	10 811	41 76	22 272			(1 778)	

August

Month	Leachate		Rainfall	Evaporation			Seepage		Net Flow	Accum
	gal	cu ft	inches	cu ft	inches	cu ft	gal	cu ft	cu ft	cu ft
JAN	6 082	813	1 19	635	0 82	437			1 010	3 719
FEB	5,702	762	1 18	629	1 27	677			714	4 433
MAR	4,453	595	2 32	1,237	2 35	1 253			579	5 012
APR	3 693	494	2 49	1,328	3 69	1,968			(146)	4 866
MAY	1 521	203	1 91	1,019	5 30	2,827			(1 605)	3 261
JUN	1 249	167	1 11	592	6 46	3,456			(2 697)	564
JUL	8,526	1,140	1 92	1,024	7 37	3 931			(1,767)	(1 203)
AUG	10,209	1,365	2 74	1,461	5 62	2,997			(171)	(1,374)
SEP	9 232	1 234	1 45	773	4 28	2 283			(275)	(1,650)
OCT	8 363	1 118	1 84	981	2 59	1,381			718	718
NOV	7,060	944	1 19	635	1 22	651			928	1 646
DEC	6 354	849	1 17	624	0 77	411			1,063	2 708
TOTAL	72 443	9 684	20 51	10 939	41 76	22 272			(1 650)	

September

Month	Leachate		Rainfall	Evaporation			Seepage		Net Flow	Accum
	gal	cu ft	inches	cu ft.	inches	cu ft	gal	cu ft	cu ft	cu ft
JAN	6,082	813	1 19	635	0 82	437			1 010	3,719
FEB	5 702	762	1 18	629	1 27	677			714	4 433
MAR	4,453	595	2 32	1,237	2 35	1,253			579	5 012
APR	3,693	494	2 49	1,328	3 69	1 968			(146)	4,866
MAY	1,521	203	1 91	1,019	5 30	2 827			(1,605)	3 261
JUN	1 249	167	1 11	592	6 48	3 456			(2,697)	564
JUL	8 526	1,140	1 92	1,024	7 37	3,931			(1 767)	(1 203)
AUG	10 209	1 365	0 94	501	6 35	3,387			(1 521)	(2,724)
SEP	9,232	1,234	4 32	2,304	3 39	1 808			1,730	(994)
OCT	8,363	1 118	1 84	981	2 59	1 381			718	718
NOV	7,060	944	1 19	635	1 22	651			928	1 646
DEC	6 354	849	1 17	624	0 77	411			1 063	2 708
TOTAL	72 443	9 684	21 58	11 509	41 60	22 187			(994)	

October

Month	Leachate		Rainfall	Evaporation			Seepage		Net Flow	Accum
	gal	cu ft	inches	cu ft	inches	cu ft	gal	cu ft	cu ft	cu ft
JAN	6 082	813	1 19	635	0 82	437			1,010	5 313
FEB	5 702	762	1 18	629	1 27	677			714	6 027
MAR	4 453	595	2 32	1,237	2 35	1 253			579	6 607
APR	3 693	494	2 49	1 328	3 69	1 968			(146)	6 460
MAY	1,521	203	1 91	1 019	5 30	2 827			(1 605)	4 856
JUN	1,249	167	1 11	592	6 48	3 456			(2 697)	2 158
JUL	8 526	1 140	1 92	1 024	7 37	3,931			(1 767)	391
AUG	10 209	1 365	0 94	501	6 35	3 387			(1,521)	(1 129)
SEP	9 232	1,234	1 54	821	4 28	2 283			(227)	(1 356)
OCT	8 363	1,118	3 96	2,112	1 72	917			2 313	2 313
NOV	7,060	944	1 19	635	1 22	651			928	3 240
DEC	6 354	849	1 17	624	0 77	411			1 063	4 303
TOTAL	72 443	9 684	20 92	11 157	41 62	22 197			(1 356)	

November

Month	Leachate		Rainfall	Evaporation			Seepage		Net Flow	Accum
	gal	cu ft	inches	cu ft	inches	cu ft	gal	cu ft.	cu ft	cu ft
JAN	6 082	813	1 19	635	0 82	437			1,010	5 201
FEB	5 702	762	1 18	629	1 27	677			714	5,915
MAR	4 453	595	2 32	1,237	2 35	1,253			579	8 495
APR	3,693	494	2 49	1 328	3 69	1 968			(146)	6 348
MAY	1,521	203	1 91	1 019	5 30	2 827			(1 605)	4 744
JUN	1,249	167	1 11	592	6 48	3 456			(2 697)	2,046
JUL	8 526	1 140	1 92	1,024	7 37	3 931			(1,767)	279
AUG	10,209	1,365	0 94	501	6 35	3,387			(1,521)	(1,241)
SEP	9,232	1 234	1 54	821	4 28	2 283			(227)	(1 468)
OCT	8,363	1,118	1 81	965	2 59	1 381			702	702
NOV	7,060	944	3 53	1 883	0 75	400			2,426	3,128
DEC	6 354	849	1 17	624	0 77	411			1,063	4 191
TOTAL	72 443	9 684	21 11	11 259	42 02	22 411			(1 468)	

December

Month	Leachate		Rainfall	Evaporation			Seepage		Net Flow	Accum
	gal	cu ft	inches	cu ft	inches	cu ft.	gal	cu ft	cu ft.	cu ft
JAN	6 082	813	1 19	635	0 82	437			1 010	5 121
FEB	5,702	762	1 18	629	1 27	677			714	5 835
MAR	4,453	595	2 32	1,237	2 35	1,253			579	6 415
APR	3,693	494	2 49	1 328	3 69	1 968			(146)	6,268
MAY	1,521	203	1 91	1,019	5 30	2,827			(1 605)	4 664
JUN	1,249	167	1 11	592	6 48	3,456			(2 697)	1,966
JUL	8 526	1,140	1 92	1,024	7 37	3 931			(1 767)	199
AUG	10 209	1 365	0 94	501	6 35	3 387			(1 521)	(1 321)
SEP	9,232	1 234	1 54	821	4 28	2 283			(227)	(1 548)
OCT	8 363	1 118	1 81	965	2 59	1 381			702	702
NOV	7,060	944	1 69	901	1 22	651			1,194	1,896
DEC	6,354	849	3 14	1 675	0 58	309			2 215	4 111
TOTAL	72 443	9 684	21 24	11 328	42 30	22 560			(1 548)	

APPENDIX I
LANDFILL GAS EMISSIONS CALCULATIONS

EPA DEFAULT PARAMETERS

Source X \SHIRE\1DRAWING\PROMON~1\CLASSI~1\PERMIT~1\LANDGEM\1500SLC PRM

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Model Parameters

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Lo	169 9 m^3/Mg	***** User Mode Selection *****
k	0 02 1/yr	***** User Mode Selection *****
NMOC	300 ppmv	***** User Mode Selection *****
Methane	50% volume	
Carbon Dioxide	50% volume	

==

Landfill Parameters

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Landfill type No Co-Disposal
Year Opened 2003 Current Year 2091 Closure Year 2090
Capacity 314563700 Mg
Average Acceptance Rate Required from
Current Year to Closure Year 5035673 Mg/year

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Model Results

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Year	NMOC Emission Rate Refuse In Place (Mg	(Mg/yr)	(Cubic m/yr)
2004	4 08E+05	2 98E+00	8 32E+02
2005	1 02E+06	7 40E+00	2 06E+03
2006	1 84E+06	1 32E+01	3 69E+03
2007	2 68E+06	1 91E+01	5 33E+03
2008	3 54E+06	2 51E+01	6 99E+03
2009	4 44E+06	3 11E+01	8 67E+03
2010	5 36E+06	3 72E+01	1 04E+04
2011	6 30E+06	4 34E+01	1 21E+04
2012	7 28E+06	4 96E+01	1 38E+04
2013	8 28E+06	5 60E+01	1 56E+04
2014	9 32E+06	6 24E+01	1 74E+04
2015	1 04E+07	6 90E+01	1 92E+04
2016	1 15E+07	7 56E+01	2 11E+04
2017	1 26E+07	8 24E+01	2 30E+04
2018	1 38E+07	8 93E+01	2 49E+04
2019	1 50E+07	9 63E+01	2 69E+04
2020	1 62E+07	1 03E+02	2 88E+04
2021	1 75E+07	1 11E+02	3 09E+04
2022	1 88E+07	1 18E+02	3 29E+04
2023	2 01E+07	1 26E+02	3 50E+04
2024	2 15E+07	1 33E+02	3 72E+04
2025	2 30E+07	1 41E+02	3 94E+04
2026	2 44E+07	1 49E+02	4 16E+04
2027	2 60E+07	1 57E+02	4 39E+04
2028	2 75E+07	1 66E+02	4 62E+04
2029	2 91E+07	1 74E+02	4 85E+04
2030	3 08E+07	1 83E+02	5 10E+04

2031	3 25E+07	1 92E+02	5 34E+04
2032	3 43E+07	2 01E+02	5 60E+04
2033	3 61E+07	2 10E+02	5 86E+04
2034	3 79E+07	2 19E+02	6 12E+04
2035	3 99E+07	2 29E+02	6 39E+04
2036	4 19E+07	2 39E+02	6 67E+04
2037	4 39E+07	2 49E+02	6 95E+04
2038	4 60E+07	2 60E+02	7 25E+04
2039	4 82E+07	2 70E+02	7 54E+04
2040	5 04E+07	2 81E+02	7 85E+04
2041	5 27E+07	2 93E+02	8 16E+04
2042	5 51E+07	3 04E+02	8 48E+04
2043	5 75E+07	3 16E+02	8 81E+04
2044	6 00E+07	3 28E+02	9 15E+04
2045	6 26E+07	3 40E+02	9 49E+04
2046	6 53E+07	3 53E+02	9 85E+04
2047	6 80E+07	3 66E+02	1 02E+05
2048	7 08E+07	3 80E+02	1 06E+05
2049	7 37E+07	3 93E+02	1 10E+05
2050	7 67E+07	4 07E+02	1 14E+05
2051	7 98E+07	4 22E+02	1 18E+05
2052	8 30E+07	4 37E+02	1 22E+05
2053	8 63E+07	4 52E+02	1 26E+05
2054	8 96E+07	4 68E+02	1 31E+05
2055	9 31E+07	4 84E+02	1 35E+05
2056	9 67E+07	5 01E+02	1 40E+05
2057	1 00E+08	5 18E+02	1 44E+05
2058	1 04E+08	5 35E+02	1 49E+05
2059	1 08E+08	5 53E+02	1 54E+05
2060	1 12E+08	5 72E+02	1 59E+05
2061	1 16E+08	5 91E+02	1 65E+05
2062	1 21E+08	6 10E+02	1 70E+05
2063	1 25E+08	6 30E+02	1 76E+05
2064	1 30E+08	6 51E+02	1 82E+05
2065	1 34E+08	6 72E+02	1 88E+05
2066	1 39E+08	6 94E+02	1 94E+05
2067	1 44E+08	7 16E+02	2 00E+05
2068	1 49E+08	7 39E+02	2 06E+05
2069	1 54E+08	7 63E+02	2 13E+05
2070	1 60E+08	7 88E+02	2 20E+05
2071	1 65E+08	8 13E+02	2 27E+05
2072	1 71E+08	8 39E+02	2 34E+05
2073	1 77E+08	8 65E+02	2 41E+05
2074	1 83E+08	8 93E+02	2 49E+05
2075	1 89E+08	9 21E+02	2 57E+05
2076	1 96E+08	9 50E+02	2 65E+05
2077	2 02E+08	9 80E+02	2 73E+05
2078	2 09E+08	1 01E+03	2 82E+05
2079	2 16E+08	1 04E+03	2 91E+05
2080	2 24E+08	1 08E+03	3 00E+05
2081	2 24E+08	1 05E+03	2 94E+05
2082	2 24E+08	1 03E+03	2 88E+05

2083	2 24E+08	1 01E+03	2 82E+05
2084	2 24E+08	9 92E+02	2 77E+05
2085	2 24E+08	9 72E+02	2 71E+05
2086	2 24E+08	9 53E+02	2 66E+05
2087	2 24E+08	9 34E+02	2 61E+05
2088	2 24E+08	9 16E+02	2 56E+05
2089	2 24E+08	8 98E+02	2 50E+05
2090	2 24E+08	8 80E+02	2 45E+05
2091	2 24E+08	8 62E+02	2 41E+05
2092	2 24E+08	8 45E+02	2 36E+05
2093	2 24E+08	8 29E+02	2 31E+05
2094	2 24E+08	8 12E+02	2 27E+05
2095	2 24E+08	7 96E+02	2 22E+05
2096	2 24E+08	7 80E+02	2 18E+05
2097	2 24E+08	7 65E+02	2 13E+05
2098	2 24E+08	7 50E+02	2 09E+05
2099	2 24E+08	7 35E+02	2 05E+05
2100	2 24E+08	7 20E+02	2 01E+05
2101	2 24E+08	7 06E+02	1 97E+05
2102	2 24E+08	6 92E+02	1 93E+05
2103	2 24E+08	6 78E+02	1 89E+05
2104	2 24E+08	6 65E+02	1 86E+05
2105	2 24E+08	6 52E+02	1 82E+05
2106	2 24E+08	6 39E+02	1 78E+05
2107	2 24E+08	6 26E+02	1 75E+05
2108	2 24E+08	6 14E+02	1 71E+05
2109	2 24E+08	6 02E+02	1 68E+05
2110	2 24E+08	5 90E+02	1 65E+05
2111	2 24E+08	5 78E+02	1 61E+05
2112	2 24E+08	5 67E+02	1 58E+05
2113	2 24E+08	5 55E+02	1 55E+05
2114	2 24E+08	5 44E+02	1 52E+05
2115	2 24E+08	5 34E+02	1 49E+05
2116	2 24E+08	5 23E+02	1 46E+05
2117	2 24E+08	5 13E+02	1 43E+05
2118	2 24E+08	5 03E+02	1 40E+05
2119	2 24E+08	4 93E+02	1 37E+05
2120	2 24E+08	4 83E+02	1 35E+05
2121	2 24E+08	4 73E+02	1 32E+05
2122	2 24E+08	4 64E+02	1 29E+05
2123	2 24E+08	4 55E+02	1 27E+05
2124	2 24E+08	4 46E+02	1 24E+05
2125	2 24E+08	4 37E+02	1 22E+05
2126	2 24E+08	4 28E+02	1 20E+05
2127	2 24E+08	4 20E+02	1 17E+05
2128	2 24E+08	4 11E+02	1 15E+05
2129	2 24E+08	4 03E+02	1 13E+05
2130	2 24E+08	3 95E+02	1 10E+05
2131	2 24E+08	3 88E+02	1 08E+05
2132	2 24E+08	3 80E+02	1 06E+05
2133	2 24E+08	3 72E+02	1 04E+05
2134	2 24E+08	3 65E+02	1 02E+05

2135	2 24E+08	3 58E+02	9 98E+04
2136	2 24E+08	3 51E+02	9 78E+04
2137	2 24E+08	3 44E+02	9 59E+04
2138	2 24E+08	3 37E+02	9 40E+04
2139	2 24E+08	3 30E+02	9 21E+04
2140	2 24E+08	3 24E+02	9 03E+04
2141	2 24E+08	3 17E+02	8 85E+04
2142	2 24E+08	3 11E+02	8 68E+04
2143	2 24E+08	3 05E+02	8 50E+04
2144	2 24E+08	2 99E+02	8 34E+04
2145	2 24E+08	2 93E+02	8 17E+04
2146	2 24E+08	2 87E+02	8 01E+04
2147	2 24E+08	2 81E+02	7 85E+04
2148	2 24E+08	2 76E+02	7 69E+04
2149	2 24E+08	2 70E+02	7 54E+04
2150	2 24E+08	2 65E+02	7 39E+04
2151	2 24E+08	2 60E+02	7 25E+04
2152	2 24E+08	2 55E+02	7 10E+04
2153	2 24E+08	2 50E+02	6 96E+04
2154	2 24E+08	2 45E+02	6 82E+04
2155	2 24E+08	2 40E+02	6 69E+04
2156	2 24E+08	2 35E+02	6 56E+04
2157	2 24E+08	2 30E+02	6 43E+04
2158	2 24E+08	2 26E+02	6 30E+04
2159	2 24E+08	2 21E+02	6 18E+04
2160	2 24E+08	2 17E+02	6 05E+04
2161	2 24E+08	2 13E+02	5 93E+04
2162	2 24E+08	2 08E+02	5 82E+04
2163	2 24E+08	2 04E+02	5 70E+04
2164	2 24E+08	2 00E+02	5 59E+04
2165	2 24E+08	1 96E+02	5 48E+04
2166	2 24E+08	1 92E+02	5 37E+04
2167	2 24E+08	1 89E+02	5 26E+04
2168	2 24E+08	1 85E+02	5 16E+04
2169	2 24E+08	1 81E+02	5 06E+04
2170	2 24E+08	1 78E+02	4 96E+04
2171	2 24E+08	1 74E+02	4 86E+04
2172	2 24E+08	1 71E+02	4 76E+04
2173	2 24E+08	1 67E+02	4 67E+04
2174	2 24E+08	1 64E+02	4 57E+04
2175	2 24E+08	1 61E+02	4 48E+04
2176	2 24E+08	1 58E+02	4 40E+04
2177	2 24E+08	1 54E+02	4 31E+04
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2180	2 24E+08	1 45E+02	4 06E+04
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2184	2 24E+08	1 34E+02	3 75E+04
2185	2 24E+08	1 32E+02	3 67E+04
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2187	2 24E+08	1 26E+02	3 53E+04
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2190	2 24E+08	1 19E+02	3 32E+04
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2196	2 24E+08	1 06E+02	2 95E+04
2197	2 24E+08	1 04E+02	2 89E+04
2198	2 24E+08	1 02E+02	2 83E+04
2199	2 24E+08	9 95E+01	2 77E+04
2200	2 24E+08	9 75E+01	2 72E+04
2201	2 24E+08	9 56E+01	2 67E+04
2202	2 24E+08	9 37E+01	2 61E+04
2203	2 24E+08	9 18E+01	2 56E+04
2204	2 24E+08	9 00E+01	2 51E+04
2205	2 24E+08	8 82E+01	2 46E+04
2206	2 24E+08	8 65E+01	2 41E+04
2207	2 24E+08	8 48E+01	2 36E+04
2208	2 24E+08	8 31E+01	2 32E+04
2209	2 24E+08	8 14E+01	2 27E+04
2210	2 24E+08	7 98E+01	2 23E+04
2211	2 24E+08	7 82E+01	2 18E+04
2212	2 24E+08	7 67E+01	2 14E+04
2213	2 24E+08	7 52E+01	2 10E+04
2214	2 24E+08	7 37E+01	2 06E+04
2215	2 24E+08	7 22E+01	2 02E+04
2216	2 24E+08	7 08E+01	1 98E+04
2217	2 24E+08	6 94E+01	1 94E+04
2218	2 24E+08	6 80E+01	1 90E+04
2219	2 24E+08	6 67E+01	1 86E+04
2220	2 24E+08	6 53E+01	1 82E+04
2221	2 24E+08	6 41E+01	1 79E+04
2222	2 24E+08	6 28E+01	1 75E+04
2223	2 24E+08	6 15E+01	1 72E+04
2224	2 24E+08	6 03E+01	1 68E+04
2225	2 24E+08	5 91E+01	1 65E+04
2226	2 24E+08	5 80E+01	1 62E+04
2227	2 24E+08	5 68E+01	1 59E+04
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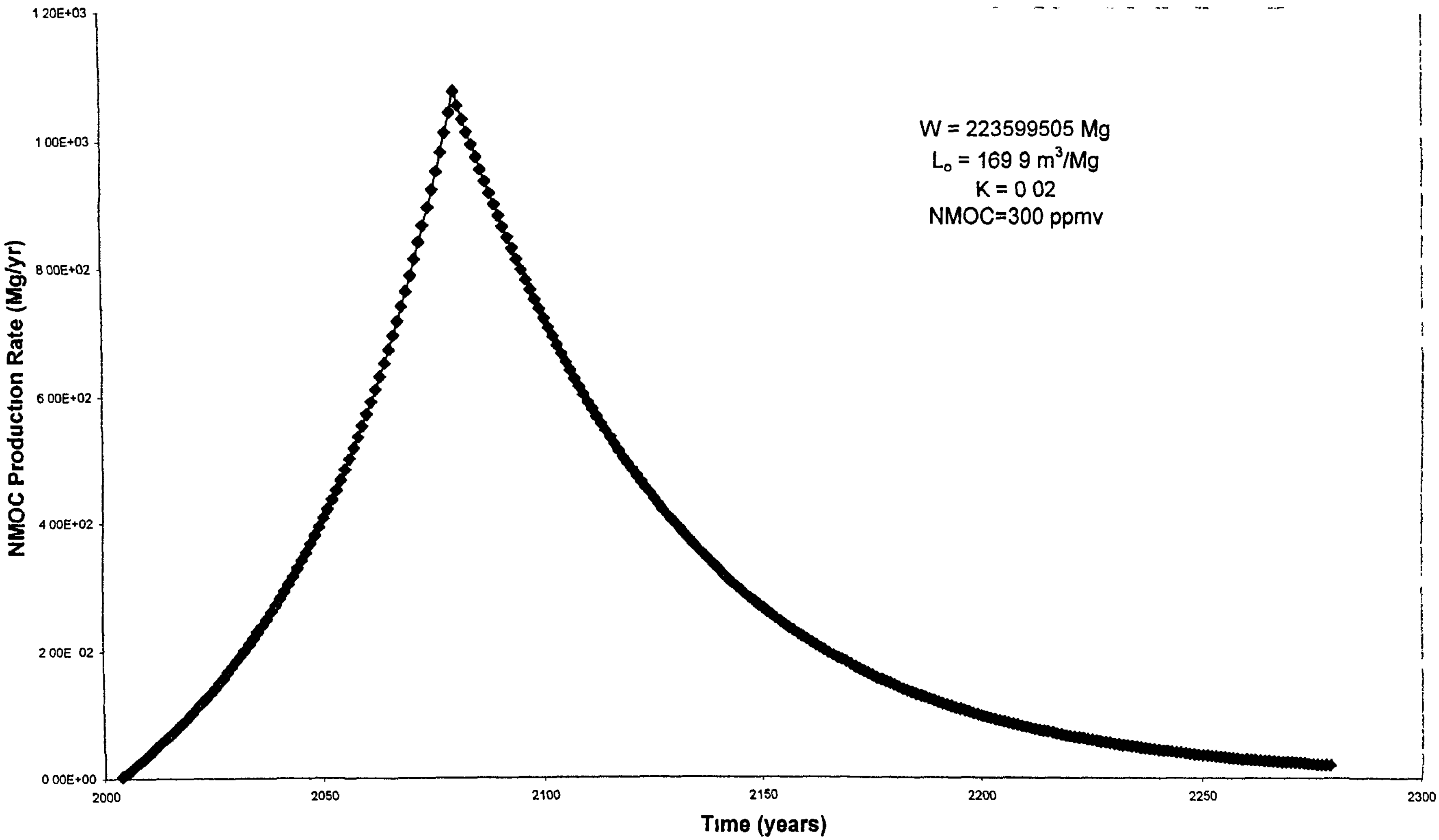
2229	2 24E+08	5 46E+01	1 52E+04
2230	2 24E+08	5 35E+01	1 49E+04
2231	2 24E+08	5 24E+01	1 46E+04
2232	2 24E+08	5 14E+01	1 43E+04
2233	2 24E+08	5 04E+01	1 41E+04
2234	2 24E+08	4 94E+01	1 38E+04
2235	2 24E+08	4 84E+01	1 35E+04
2236	2 24E+08	4 75E+01	1 32E+04
2237	2 24E+08	4 65E+01	1 30E+04
2238	2 24E+08	4 56E+01	1 27E+04

2239	2 24E+08	4 47E+01	1 25E+04
2240	2 24E+08	4 38E+01	1 22E+04
2241	2 24E+08	4 29E+01	1 20E+04
2242	2 24E+08	4 21E+01	1 17E+04
2243	2 24E+08	4 13E+01	1 15E+04
2244	2 24E+08	4 04E+01	1 13E+04
2245	2 24E+08	3 96E+01	1 11E+04
2246	2 24E+08	3 89E+01	1 08E+04
2247	2 24E+08	3 81E+01	1 06E+04
2248	2 24E+08	3 73E+01	1 04E+04
2249	2 24E+08	3 66E+01	1 02E+04
2250	2 24E+08	3 59E+01	1 00E+04
2251	2 24E+08	3 52E+01	9 81E+03
2252	2 24E+08	3 45E+01	9 61E+03
2253	2 24E+08	3 38E+01	9 42E+03
2254	2 24E+08	3 31E+01	9 24E+03
2255	2 24E+08	3 25E+01	9 05E+03
2256	2 24E+08	3 18E+01	8 87E+03
2257	2 24E+08	3 12E+01	8 70E+03
2258	2 24E+08	3 06E+01	8 53E+03
2259	2 24E+08	3 00E+01	8 36E+03
2260	2 24E+08	2 94E+01	8 19E+03
2261	2 24E+08	2 88E+01	8 03E+03
2262	2 24E+08	2 82E+01	7 87E+03
2263	2 24E+08	2 77E+01	7 71E+03
2264	2 24E+08	2 71E+01	7 56E+03
2265	2 24E+08	2 66E+01	7 41E+03
2266	2 24E+08	2 60E+01	7 27E+03
2267	2 24E+08	2 55E+01	7 12E+03
2268	2 24E+08	2 50E+01	6 98E+03
2269	2 24E+08	2 45E+01	6 84E+03
2270	2 24E+08	2 40E+01	6 71E+03
2271	2 24E+08	2 36E+01	6 57E+03
2272	2 24E+08	2 31E+01	6 44E+03
2273	2 24E+08	2 26E+01	6 32E+03
2274	2 24E+08	2 22E+01	6 19E+03
2275	2 24E+08	2 18E+01	6 07E+03
2276	2 24E+08	2 13E+01	5 95E+03
2277	2 24E+08	2 09E+01	5 83E+03
2278	2 24E+08	2 05E+01	5 72E+03
2279	2 24E+08	2 01E+01	5 60E+03

SLC PROJECTED NMOC Emission Rate



APPENDIX J
RUN-ON/RUN-OFF CALCULATIONS

PRE-DEVELOPED DRAINAGE ANALYSIS

TIME OF CONCENTRATION
PREDEVELOPED DRAINAGE ANALYSIS

Sheet Flow

Descnption	Predeveloped Dramage
Mannmg's n	0 1300
Flow Length	300 0000 ft
Two Yr, 24 hr Rainfall	1 100 in
Land Slope	0 2000 ft/ft
Computed Sheet flow time	> 0 2381 hrs

Shallow Concentrated Flow

Descnption	Predeveloped Dramage
Surface	Unpaved
Flow Length	1000 0000 ft
Watercourse Slope	0 500 ft/ft
Velocity	11 4088 fps
Computed Shallow flow time	> 0 0243 hrs

Channel Flow

Descnption	Predeveloped Dramage
Flow Area	8 0000 ft2
Wetted Penmeter	96 0000 in
Flow Length	16846 0000 ft
Channel Slope	0 0940 ft/ft
Manning's n	0 0200
Hydraulic Radius	12 0000 in
Velocity	22 7799 fps
Computed Channel flow time	> 0 2054 hrs

Total Time of Concentration	> 0 4678 hrs

****

PEAK DISCHARGE
PREDEVELOPED DRAINAGE ANALYSIS

SCS TR-55 Graphical Peak Discharge method

Given Input Data	
Description	Predeveloped Drainage
Rainfall distribution	Type II
Frequency	25 year
Rainfall, P (24-hours)	2 2000 in
Drainage area	3 0700 mi2
Runoff curve number, CN	67
Time of concentration, Tc	0 4678 hrs
Pond and Swamp Areas	0 0000 % of Area
Computed Results	
Initial abstraction, Ia	0 9851 in
Ia/P	0 4478
Unit peak discharge, qu	303 2220 csm/in
Runoff, Q	0 2404 in
Pond and swamp adjustment, Fp	1 0000
Peak discharge, qp	223 7736 cfs

The peak discharge of 223 8 cfs was calculated for predeveloped conditions

DEVELOPED DRAINAGE ANALYSIS

TIME OF CONCENTRATION
DEVELOPED DRAINAGE ANALYSIS

Sheet Flow

Descnption	Developed Drainage
Mannmg's n	0 1300
Flow Length	300 0000 ft
Two Yr, 24 hr Rainfall	1 100 in
Land Slope	0 2000 ft/ft
Computed Sheet flow time	> 0 2381 hrs

Shallow Concentrated Flow

Descnption	Developed Drainage
Surface	Unpaved
Flow Length	1000 0000 ft
Watercourse Slope	0 500 ft/ft
Velocity	11 4088 fps
Computed Shallow flow time	> 0 0243 hrs

Channel Flow

Descnption	Developed Drainage
Flow Area	8 0000 ft2
Wetted Penmeter	96 0000 in
Flow Length	19402 0000 ft
Channel Slope	0 0760 ft/ft
Mannmg's n	0 0200
Hydraulic Radius	12 0000 in
Velocity	20 4831 fps
Computed Channel flow time	> 0 2631 hrs

Total Time of Concentration > 0 5255 hrs
****

PEAK DISCHARGE
DEVELOPED DRAINAGE ANALYSIS

SCS TR-55 Graphical Peak Discharge method

Given Input Data	
Description	Developed Drainage
Rainfall distribution	Type II
Frequency	25 year
Rainfall, P (24-hours)	2 2000 in
Drainage area	3 0700 mi2
Runoff curve number, CN	67
Time of concentration, Tc	0 5255 hrs
Pond and Swamp Areas	0 0000 % of Area
Computed Results	
Initial abstraction, Ia	0 9851 in
Ia/P	0 4478
Unit peak discharge, qu	284 2146 csm/in
Runoff, Q	0 2404 in
Pond and swamp adjustment, Fp	1 0000
Peak discharge, qp	209 7464 cfs

The peak discharge of 209 7 cfs was calculated for developed conditions, which is less than peak discharge in predeveloped condition

APPENDIX K
LIFE EXPECTANCY CALCULATIONS

Anticipated Life Span of Class I Landfill

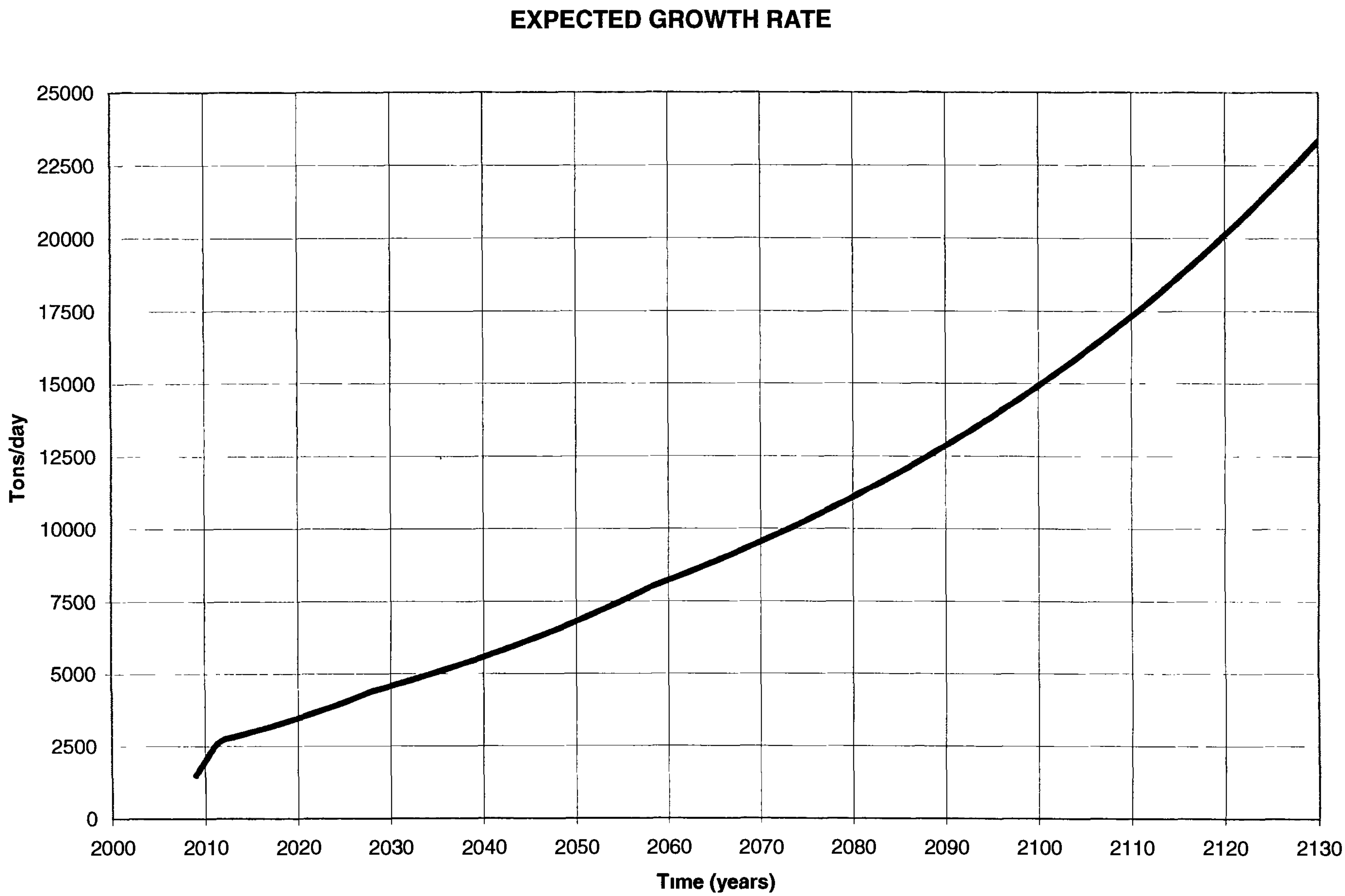
Year	Tons/day	Tons/year	Accum Tons
2009	1500	450000	4 50E+05
2010	2000	600000	1 05E+06
2011	2500	750000	1 80E+06
2012	2750	825000	2 63E+06
2013	2833	849750	3 47E+06
2014	2917	875242 5	4 35E+06
2015	3005	901499 8	5 25E+06
2016	3095	928544 8	6 18E+06
2017	3188	956401 1	7 14E+06
2018	3284	985093 1	8 12E+06
2019	3382	1014646	9 14E+06
2020	3484	1045085	1 02E+07
2021	3588	1076438	1 13E+07
2022	3696	1108731	1 24E+07
2023	3807	1141993	1 35E+07
2024	3921	1176253	1 47E+07
2025	4038	1211540	1 59E+07
2026	4160	1247887	1 71E+07
2027	4284	1285323	1 84E+07
2028	4413	1323883	1 98E+07
2029	4501	1350360	2 11E+07
2030	4591	1377368	2 25E+07
2031	4683	1404915	2 39E+07
2032	4777	1433013	2 53E+07
2033	4872	1461674	2 68E+07
2034	4970	1490907	2 83E+07
2035	5069	1520725	2 98E+07
2036	5170	1551140	3 13E+07
2037	5274	1582163	3 29E+07
2038	5379	1613806	3 45E+07
2039	5487	1646082	3 62E+07
2040	5597	1679004	3 79E+07
2041	5709	1712584	3 96E+07
2042	5823	1746835	4 13E+07
2043	5939	1781772	4 31E+07
2044	6058	1817407	4 49E+07
2045	6179	1853756	4 68E+07
2046	6303	1890831	4 87E+07
2047	6429	1928647	5 06E+07
2048	6557	1967220	5 26E+07
2049	6689	2006565	5 46E+07
2050	6822	2046696	5 66E+07
2051	6959	2087630	5 87E+07
2052	7098	2129382	6 08E+07
2053	7240	2171970	6 30E+07
2054	7385	2215409	6 52E+07
2055	7532	2259718	6 75E+07
2056	7683	2304912	6 98E+07
2057	7837	2351010	7 21E+07
2058	7993	2398030	7 45E+07
2059	8113	2434001	7 70E+07
2060	8235	2470511	7 94E+07
2061	8359	2507569	8 19E+07
2062	8484	2545182	8 45E+07
2063	8611	2583360	8 71E+07
2064	8740	2622110	8 97E+07

ASSUMPTIONS USED IN CALCULATIONS

1000 usable acres for Class I disposal
Unit weight of MSW is 1200 lb/yd3
1500 tons/day for the first year of operation
2000 tons/day for the second year of operation
2500 tons/day for the third year of operation
2750 tons/day for the fourth year of operation
3% annual growth rate after the fourth year of operation
2% annual growth rate after the twentieth year of operation
1 5% annual growth rate after the fiftieth year of operation
10% reduction for intermediate cover

Volume (yd3)	642 124 250
SW of MSW (lb/yd3)	1 200
Waste (lb)	770 549 100 000
Waste (tons)	385 274 550
Landuse Factor	0 9
Total Waste (tons)	346 747 095
Years	121

2065	8871	2661442	9 24E+07
2066	9005	2701364	9 51E+07
2067	9140	2741884	9 78E+07
2068	9277	2783012	1 01E+08
2069	9416	2824757	1 03E+08
2070	9557	2867129	1 06E+08
2071	9700	2910136	1 09E+08
2072	9846	2953788	1 12E+08
2073	9994	2998095	1 15E+08
2074	10144	3043066	1 18E+08
2075	10296	3088712	1 21E+08
2076	10450	3135043	1 24E+08
2077	10607	3182068	1 28E+08
2078	10766	3229799	1 31E+08
2079	10927	3278246	1 34E+08
2080	11091	3327420	1 37E+08
2081	11258	3377331	1 41E+08
2082	11427	3427991	1 44E+08
2083	11598	3479411	1 48E+08
2084	11772	3531602	1 51E+08
2085	11949	3584576	1 55E+08
2086	12128	3638345	1 58E+08
2087	12310	3692920	1 62E+08
2088	12494	3748314	1 66E+08
2089	12682	3804539	1 70E+08
2090	12872	3861607	1 74E+08
2091	13065	3919531	1 77E+08
2092	13261	3978324	1 81E+08
2093	13460	4037999	1 86E+08
2094	13662	4098569	1 90E+08
2095	13867	4160047	1 94E+08
2096	14075	4222448	1 98E+08
2097	14286	4285785	2 02E+08
2098	14500	4350071	2 07E+08
2099	14718	4415322	2 11E+08
2100	14939	4481552	2 16E+08
2101	15163	4548776	2 20E+08
2102	15390	4617007	2 25E+08
2103	15621	4686262	2 29E+08
2104	15855	4756556	2 34E+08
2105	16093	4827905	2 39E+08
2106	16334	4900323	2 44E+08
2107	16579	4973828	2 49E+08
2108	16828	5048435	2 54E+08
2109	17081	5124162	2 59E+08
2110	17337	5201024	2 64E+08
2111	17597	5279040	2 69E+08
2112	17861	5358225	2 75E+08
2113	18129	5438599	2 80E+08
2114	18401	5520178	2 86E+08
2115	18677	5602980	2 91E+08
2116	18957	5687025	2 97E+08
2117	19241	5772331	3 03E+08
2118	19530	5858915	3 09E+08
2119	19823	5946799	3 15E+08
2120	20120	6036001	3 21E+08
2121	20422	6126541	3 27E+08
2122	20728	6218439	3 33E+08
2123	21039	6311716	3 39E+08
2124	21355	6406392	3 46E+08
2125	21675	6502488	3 52E+08
2126	22000	6600025	3 59E+08
2127	22330	6699025	3 66E+08
2128	22665	6799511	3 72E+08
2129	23005	6901503	3 79E+08
2130	23350	7005026	3 86E+08


EXPECTED GROWTH RATE
Tons/day
25000
22500
20000
17500
15000
12500
10000
7500
5000
2500
0
2000
2010
2020
2030
2040
2050
2060
2070
2080
2090
2100
2110
2120
2130
Time (years)

APPENDIX L
FUGITIVE WASTE PLAN

APPENDIX L

FUGITIVE WASTE PLAN

Introduction

Promontory Landfill LLC is committed to use management, engineering, process, and personnel controls to aggressively limit the occurrence of fugitive waste

Description of potential fugitive waste generators and prevention and control steps

Waste loads entering the landfill must be covered Promontory Landfill LLC will purchase containers that are equipped with covers In the unlikely event of receiving an uncovered load, it will be stopped for corrective actions First time violators will receive a one-time warning Repeat violators will be subject to increased disposal fees

Upon entering the site, waste loads will be taken to an enclosed transfer station The transfer station will specifically be designed with prevention of fugitive waste in mind The transfer of waste from incoming containers either by truck or rail will be contained within the transfer station Incoming containers would be removed and loaded to onsite haul trucks for transit and unloading at the working face Empty containers will be cleaned either at the working face, inside the transfer building, or in a fenced compound before being placed back into service Waste inside the transfer station will be picked up daily with though cleaning conducted weekly

The closest weather station to Promontroy Landfill sits atop the mountain above the landfill Per Dr Hohne Horel of the Department of Meteorolgy at the University of Utah, the wind data generated frome this weather station is not necessarily representative of the conditions at the landfill site due to the difference in elevation and topography The applicant therefore, will construct and operate a weather station at the landfill site Information from the weather station will be recorded into the Daily Operating Record From this information, the applicant will be able to ascertain what wind events (velocity, duration, and direction) compromise the effectiveness of applicant's fugitive waste control measures

Data from the applicant's weather station will be initially collected for one year Within 60 days of the end of the first year's operations, applicant will present to the Executive Secretary for approval a protocol outlining wind thresholds (velocity, duration, and direction) requiring possible cessation of operations at the tipping face

During the first year while applicant is developing its data base and protocol applicant will voluntarily cease placing waste at the tipping face during any wind event m which the following occur

- Wind direction is from due north to due east
- Wind velocity exceeds 35 mph for 30 minutes or longer

Prior to implementation of a protocol, the applicant will take necessary preventative actions to stop fugitive waste during cessation of operations cause by wind events

The buffer area around the disposal area will be given special attention, as it is the final opportunity to prevent fugitive waste from leaving the site A five-foot high berm would be built and topped with a 15-foot high fence The fence and berm combination would begin on the hill along the east side, wrap around the south side of the property and then run along the west side to a point where the property begins to gain significant elevation The remainder of the property would be fenced with a 6-foot high fence Fencing would be inspected weekly and waste cleanup and repair of the fence would occur as necessary Positive control of fugitive waste will include the cleanup of the site, including buffer areas on a weekly basis and after wind events from due north to due east during which the tipping face is exposed in excess of 35 mph that last more than thirty minutes to minimize the amount of waste reaching the perimeter fence The drivers of the haul trucks will inspect haul roads and spills will be cleaned up as reported Spills inside the site would be cleaned up as detected Any waste that escapes the site would be collected and disposed of before the end of the next working day

At the working face, fugitive waste will be minimized in multiple ways First the working face will be reduced to the smallest workable area as possible It is anticipated the working face will be about a half acre Next temporary 12' high fencing will be placed around the working face to keep fugitive waste from moving out onto the site Other temporary fencing will be erected if necessary to contain waste on site

APPENDIX M
MONITORING PLAN

Groundwater Monitoring Plan

APPENDIX M

MONITORING PLAN

The purpose of this monitoring schedule is to help prevent problems that may be preventable through identification and prompt remediation efforts A sample schedule for monitoring and inspection of the landfill facilities to ensure proper operation and maintenance is provided in the Appendix O Listed below are monitoring guidelines for groundwater monitoring, leachate monitoring and control system, and landfill gas monitoring system

1 Groundwater Monitoring System

Background concentrations of the constituents will be established using a statistical analysis method approved by the Executive Secretary Eight independent samples will be obtained and analyzed during the first year immediately after the permit is issued and prior to the receipt of MSW from the up gradient and down gradient wells After background concentrations have been determined, groundwater monitoring would be conducted semi annually in the spring and fall from the up-gradient and down gradient wells The well locations and a typical well design are shown in the attached Figure I-1, I-2, I 3, and I 4 Groundwater samples will be analyzed for detection of constituents per the Utah State Administrative Code R315 308 Ground Water Monitoring Requirements The list of constituents provided below are current as of August 2009 for detection monitoring The Landfill Operator shall be responsible for insuring compliance with current regulations for detection monitoring

A detailed, site-specific groundwater monitoring plan, including well logs, well design, and updated sampling and analysis procedures will be submitted and approved after the initial monitoring well development and prior to facility operation

Groundwater Detection Monitoring				
		Groundwater Protection Standard	Detection Limits	
			EPA 6020	Cold Vapor AAS
Inorganic Constituents	CAS	(mg/l)	(mg/l)	(mg/l)
Ammonia (as N)	7664-41-7			
Carbonate/Bicarbonate				
Calcium				
Chemical Oxygen Demand (COD)				
Chloride				
Iron	7439-89-6			
Magnesium				
Manganese	7439 96 5			
Nitrate (as N)				
pH				
Potassium				
Sodium				
Sulfate				
Total Dissolved Solids (TDS)				
Total Organic Carbon (TOC)				

Heavy Metals				
Antimony	7440-36 0	0 006	0 003	
Arsenic	7440-38-2	0 01	0 005	
Barium	7440 39-3	2	0 005	
Beryllium	7440-41 7	0 004	0 001	
Cadmium	7440-43 9	0 005	0 001	
Chromium		0 1	0 005	
Cobalt	7440 48 4	2	0 03	
Copper	7440-50 8	1 3	0 012	
Lead		0 015	0 003	
Mercury	7439-97 6	0 002		0 0002
Nickel	7440-02 0	0 1	0 01	
Selenium	7782 49-2	0 05	0 001	
Silver	7440-22 4	0 1	0 002	
Thallium		0 002	0 001	
Vanadium	7440 62 2	0 3	0 03	
Zinc	7440 66 6	5	0 03	
Organic Constituents				
Acetone	67-64 1	4	0 005	0 005
Acrylonitrile	107 13-1	0 1	0 01	0 05
Benzene	71 43 2	0 005	0 0005	0 001

Bromochloromethane	74 97-5	0 01	0 0005	0 001
Bromodichloromethane[1]	75-27-4	0 1	0 0005	0 001
Bromoform[1]	75-25 2	0 1	0 0005	0 001
Carbon disulfide	75 15 0	4	0 0005	0 001
Carbon tetrachloride	56 23 5	0 005	0 0005	0 001
Chlorobenzene	108-90 7	0 1	0 0005	0 001
Chloroethane	75 00-3	15	0 0005	0 001
Chloroform[1]	67 66 3	0 1	0 0005	0 001
Dibromochloromethane[1]	124 48-1	0 1	0 0005	0 001
1,2-Dibromo 3 chioropropane	96 12 8	0 0002	0 000005	0 00001
1,2 Dibromoethane	106 93-4	0 00005	0 000005	0 00001
1,2 Dichlorobenzene (ortho)	95 50 1	0 6	0 0005	0 001
1,4 Dichlorobenzene (para)	106 46 7	0 075	0 0005	0 001
trans 1,4-Dichloro 2 butene	110 57-6		0 01	0 02
1,1 Dichloroethane	75 34-3	4	0 0005	0 001
1,2-Dichloroethane	107-06 2	0 005	0 0005	0 001
1,1-Dichloroethylene	75 35-4	0 007	0 0005	0 001
cis 1,2-Dichloroethylene	156-59-2	0 07	0 0005	0 001
trans 1,2-Dichloroethylene	156 60 5	0 1	0 0005	0 001
1,2 Dichloropropane	78 87-5	0 005	0 0005	0 001
cis 1,3 Dichloropropene	10061 01 5	0 002	0 0005	0 001

trans 1,3 Dıchloropropene	10061-02 6	0 002	0 0005	0 001
Ethylbenzene	100-41-4	0 7	0 0005	0 001
2-Hexanone	591-78 6	1 5	0 005	0 01
Methyl bromıde	74-83 9	0 01	0 0005	0 001
Methyl chlorıde	74-87 3	0 003	0 0005	0 001
Methylene bromıde	74-95 3	0 4	0 0005	0 001
Methylene chlorıde	75 09-2	0 005	0 001	0 005
Methyl ethyl ketone	78 93 3	0 17	0 005	0 01
Methyl ıodıde	74-88 4		0 001	0 01
4 Methyl-2-pentanone	108-10 1	3	0 005	0 01
Styrene	100-42-5	0 1	0 0005	0 001
1,1,1,2-Tetrachloroethane	630-20-6	0 07	0 0005	0 001
1,1,2,2-Tetrachloroethane	79 34-5	0 005	0 0005	0 001
Tetrachloroethylene	127-18-4	0 005	0 0005	0 001
Toluene	108-88 3	1	0 0005	0 001
1,1,1 Trıchloroethane	71 55-6	0 2	0 0005	0 001
1,1,2-Trıchloroethane	79-00 5	0 005	0 0005	0 001
Trıchloroethylene	79-01 6	0 005	0 0005	0 001
Trıchlorofluoromethane	75-69 4	10	0 0005	0 001
1,2,3 Trıchloropropane	96 18 4	0 04	0 0005	0 001
Vınyl acetate	108 05-4	37	0 005	0 01

Vinyl Chloride	75 01-4	0 002	0 0005	0 005
Xylenes	1330-20 7	10	0 0005	0 001

[1]The ground water protection standard of 0 1 mg/l is for the total of Bromodichloromethane, Bromoform, Chloroform, and Dibromochloromethane

The water samples would be collected using currently accepted and approved techniques and technologies The protocols for sampling would consist of water level measurements, detection of immiscible layers, well purging, field measurements, sample collection, sample handling and preservation, and sample custody Samples would be tested using a state certified laboratory Each sampling protocol is discussed in detail below

- Water level measurements would be read to the nearest 0 01 foot Elevations at each well would be known for cross references and determination of ground water levels in the area Measurements would be taken from the same location at each well
- Detection of immiscible layers would begin with screening organic vapors with a monitor prior to any evacuation of water If concentrations were to exceed 25 percent of the lower explosive limit, landfill personnel would immediately contact the Landfill Manager If concentrations were below 25 percent of the lower explosive limit, an interface probe would be lowered into the well to detect and measure the thickness of any possible immiscible layer that may develop The probe would further be lowered to the bottom of the well to register the presence of any dense organic liquids If any immiscible layers were found, samples would carefully be retrieved
- The water level and interface probes will be cleaned prior to use and between each sampling point by washing with soapy (Alconox®) water solution, spraying de-ionized water on the outside surfaces, and wiping the outside surface with a paper towel
- Each well would be equipped with a dedicated low flow pump designed to be non-aerating or non leaching In preparation for taking water samples, each monitoring well would be micro purged to obtain a fresh sample Micropurging of a well would be performed by removing water from the well using the low flow pump When purging a well, purging would continue until the pH, conductivity, turbidity, and water temperature have stabilized or until

at least three well volumes of water would be purged from the well Stabilization would occur when pH, conductivity turbidity, and water temperature readings do not exceed 10 percent deviation over at least three measurements If the well is purged dry, samples will be taken as soon as a sufficient volume of ground water has entered the well

Field measurement samples would be collected in a clean beaker once the well was properly purged All probes or instruments would be kept in designated containers to prevent cross contamination between samples All instruments would be cleaned according to manufacturer's recommendations after and prior to taking any measurements The dedicated pumps will likely be powered by a gas powered generator Care will be taken during sampling to ensure that the generator is located downwind of the sampling area to prevent contamination from the generator exhaust

Field measurements and field notes would include

- name of collector
- time of sample
- weather conditions
- air temperature
- date of sample
- monitoring well identification number
- lower explosive limit
- immiscible layers found with thickness information
- static water level
- water temperature
- turbidity
- electrical conductivity
- pH
- dissolved oxygen
- well yield
- sampling procedures and methods
- sampling identification number
- preservatives used

- containers used
- parameters requested
- daily instrument drift
- general comments section

This information would be recorded on the Water Sample Worksheet (included at the end of this document) and kept in a field notebook All measurement instruments would be calibrated at the beginning of the day and rechecked after all the sampling was complete to record any possible instrument drift

- The pumping rate shall not exceed 100 millimeter/minute The degree of sensitivity to pH or volatilization would determine the order in which parameters are sampled Sampling containers and procedures for preparations of samples would be provided by the testing laboratory
- Quality assurance samples will include, but not be limited to a trip blank, field blank, and field duplicates The trip blank will be a vial of reagent grade water included in each cooler during sampling and shipping This blank is used to provide an indication of contamination introduced as a consequence of the sampling and shipping procedure The field blank will be a vial of reagent grade water filled in the field along with other samples taken at a selected well This blank is used to provide an indication of contamination induced during the sampling process Field duplicates will be collected at a rate of 10 percent If fewer than 10 samples are collected one field duplicate will be included
- Once the samples were collected and prepared to laboratories recommendations, the sample would be immediately labeled, recorded in the field book, and placed in a sampling cooler The samples would be recorded on a chain of custody and remain with the sampler until formally released to another individual
- Custody of the samples would be documented on a chain of custody form Samples would remain in the custody of the sampler until samples are checked in and relinquished to the laboratory or until they were relinquished for transport to the laboratory

All data received would be reviewed to assess data validity Each data report would be checked to insure the following

- Identification numbers of the samples match
- Chain of custody and field notes matches the sample information
- Sample analysis was performed using requested methods and acceptable time limits
- Reporting limits conform to current detection limits
- Blank results have been included and are acceptable
- MS/MSD results are representative and are included
- All QA/QC sampling results are included and acceptable

If there were any potential problems with the data reports or discrepancies, the laboratory would be notified immediately If necessary, new samples would be collected and tested Data would be analyzed by

- Concentrations of naturally occurring constituents would be plotted at each well on control charts for that specific well Each constituent would be analyzed to determine whether groundwater is being impacted
- Look for the presence of non-naturally occurring compounds If these compounds were reported, the validity of the results would be reviewed If results appear to be potentially valid, new samples would be collected and tested

Semi-annual reports would be prepared and would include the following in an electronic format

- Description of procedures, including the quality assurance/quality control, followed during the collection of samples
- Results of field measured parameters
- Chain of custody and quality assurance/quality control procedures followed by the laboratory
- Laboratory results with detection limits and testing methods used
- Statistical analysis of the laboratory results

After background constituent and levels have been established, the Owner would determine what statistical method would be used to determine whether a significant change has occurred compared to the background water quality

2 Leachate Monitoring and Control System

The proposed Class I Landfill would be equipped with a leachate monitoring and control system The system is comprised of a network of piping providing gravity flow to centrally located sumps positioned at the lowest elevation of the cell The sumps would be activated if more than one foot of standing leachate is detected above the liner The leachate would be pumped at a low flow rate to an evaporation basin or sprayed back on the surface of the landfill to suppress fugitive dust Evaporation basins would accommodate peak flows If the evaporation basins were unable to meet the demand generated by the leachate collection system, additional evaporation basins would be constructed

3 Landfill Gas Monitoring System

Rule R315-303 Landfilling Standards require landfill gases to be monitored to protect air quality and limit explosive gas emissions A hand-held field explosive gas meter would be used for recording at the site The meter would be calibrated as recommended by the manufacture by using a methane standard Concentrations would not be allowed to exceed 25% of the lower limit in facility structures and 100% of the lower limit around the disposal area boundary Quarterly monitoring would be performed at the locations indicated on Figure 4 5 and within all facility structures Readings would be taken at the ground level If a monitoring event were to exceed the regulatory limit procedures would be taken as noted in Section 5 2

Water Sampling Worksheet

Site ______________________ Sample Date ______________

Sample ID _______________ Sample Time ______________

☐ Grab ☐ Groundwater ☐ Surface water

Well Drilled Depth __________ ft −

Static Depth to Water __________ ft * ☐ gal /ft * **3** case volumes =

Calculated Purge Volume __________ gal

Conversion Factors – Well Casing Size

2"	**3"**	**4"**
0 16 gal /ft	**0 36** gal /ft	**0 65** gal /ft

<u>Actual</u> Volume Removed __________ gal

Comments ____

____

Water Quality Measurements

	pH	**Conductivity** mS/cm	**Turbidity** NTU	**Temperature** °C

Comments ____

____

____

Instruments used ______________ | ______________

Calibration Date ______________

Sampled By ______________

APPENDIX N
EMERGENCY OPERATIONS PLAN

APPENDIX N

EMERGENCY OPERATIONS PLAN

This document provides landfill employees with information on how to respond and what to expect in the case of a major disaster, such as an earthquake The Promontory Landfill Facility (hereafter referred to as the Facility) in an effort to respond to various disasters that could seriously threaten lives and property, has developed this Emergency Operations Plan This Plan in not meant as a stand-alone plan, the intent is to use this plan in conjunction with State, County, and Local Emergency Operations Plans The Department of Environmental Quality may elect to waive requirements for daily cover on construction and demolition materials during an emergency

ASSUMPTIONS

1 The Facility is expected to continue normal operation and must maintain normal daily operation besides handling the disposal of emergency, nonhazardous rubble material Because of the location of the Facility and the types of structures located on the premises, the Facility is expected to be minimally affected by most major disasters

2 The Facility will be most heavily impacted approximately 72-hours after an emergency, when the clean up, removal and disposal of rubble begins The Facility may then need to be open around the clock (24-hour operation) All of the Facility personnel and equipment will be needed to run the operation

3 The primary responsibility of Landfill resources would be the Rail Transfer Area/Landfill operations

FIRST RESPONSE

DURING WORKING HOURS

1 Remain calm and reassure others Avoid objects that could fall Do not touch downed power lines or objects touching downed power lines This is especially significant at the Landfill

2 Report your location, physical condition, and area damage to your supervisor

3 Provided the Facility areas are not severely damaged or inaccessible, continue with normal duties In the event that certain areas are severely damaged, perform other duties as assigned by the Supervisor

4 The Supervisor should check all areas for structure damage and also check on site utilities If necessary, turn these utilities off Call the Weber and Box Elder County dispatch at (801) 399-8411 and (435) 734-3800 to report findings

5 All efforts will be made to contact Facility employees' families and others that employees have listed on the Family Notification List Employees will be notified of family status as soon as possible

AFTER WORKING HOURS

1 Contact the Facility and give your location, status, and availability If you are unable to get to the Landfill notify the supervisor

2 The first person to arrive at the Landfill should check all structures for damage and check utilities (power, sewer, gas and water) lines If necessary, turn these off

3 After all structures and utilities have been inspected, perform normal duties unless otherwise assigned by the Supervisor

4 The Supervisor should check all areas for structure damage and also check on site utilities If necessary, turn these utilities off Call the Weber and Box Elder County dispatch at (801) 399-8411 and (435) 734-3800 to report findings

FACILITY OPERATIONS

1 The Landfill will maintain regularly scheduled working hours

2 When the emergency cleanup begins, approximately 72-hours later, the Facility may need to be open 24-hours per day

3 When 24-hour operation begins, all Facility personnel and equipment will be needed to run the Rail Transfer Area and Landfill operations

4 During the clean up and disposal of rubble, City/County and State Health Department inspectors will need to be at the clean-up site to determine if the substance being disposed of contains hazardous material If so determined, then the governing authorities (federal, state or local) must arrange for proper disposal at a designated hazardous waste disposal facility (not the Promontory Landfill Facility)

5 During 24-hour operation employees should expect to work 12-hour shifts Management will decide which employees take the first shift and which employees take the second shift according to employee availability

APPENDIX O
SAMPLE FORMS

RANDOM INSPECTION FORM

Date ______________ Time ______________

Inspected by ____________________

Load Origin ____________________

How was the inspection conducted?

____
____
____
____
____

What was found during inspection?

____
____
____
____
____
____
____
____

Is corrective action necessary? If so what?

____
____
____
____
____
____

Quarterly Inspection Log
Shoshone Promontory Landfill

Area of Inspection	Needs Repair?	Date of Repair	Comments
Off-loading Area			
Scale House			
Run-on/Run-off			
Roads			
Harborage			
Leachate Collection			
Gas Collection			
Penmeter Fencing and Access Gates			
Fugitive Waste Collection System			
Fugitive Waste			
Cell			
Soil Covenng			
Date	Inspector		

Note Annual Report Due before March 1

QUARTERLY INPECTION LOG
Promontory Landfill LLC

Area of Inspection	**Needs Repair**	**Date of Repair**	**Comments**
Off loading Area			
Scale House			
Run-on/Run-off			
Roads			
Harborage			
Leachate Collection			
Gas Collection			
Perimeter Fencing and Access Gates			
Fugitive Waste collection System			
Fugitive Waste			
Cell			
Date	Inspector		

Note Annual Report due before March 1

Landfill Gas Quarterly Monitoring Results
Promontory Landfill LLC
Year______ Quarter______

Date ____________________ Time ____________________

Name of Gas Sample Collector ____

Temperature ______________ Weather ________________

Monitoring device should be calibrated prior to initiating sampling

Accomplished? Yes___ No___

Methane Monitoring Location	**Measured % LEL**	**Regulatory Action Limit (% LEL)**
1 Administrative Building		25
2 SW Corner of Rotary Dump		25
3 SW Corner of Bottom Dump Area		25
4 SE Corner of Intermodal Area		25
5 NW Corner of the Scale House		25
6 North Boundary		100
7 South Boundary		100

- Gas Sample Collector If measured % LEL equals or exceeds internal action limit, contact the facility manager
- Facility Manager If measured %LEL equals or exceeds regulatory action limit, notify the State Director in compliance with 40 CFR 258 23(c)

Comments
____
____
____
____
____
____
____

FAMILY NOTIFICATION LIST
Promontory Landfill LLC

	Emergency Contact		
Employee Name	Name	Telephone #	Address